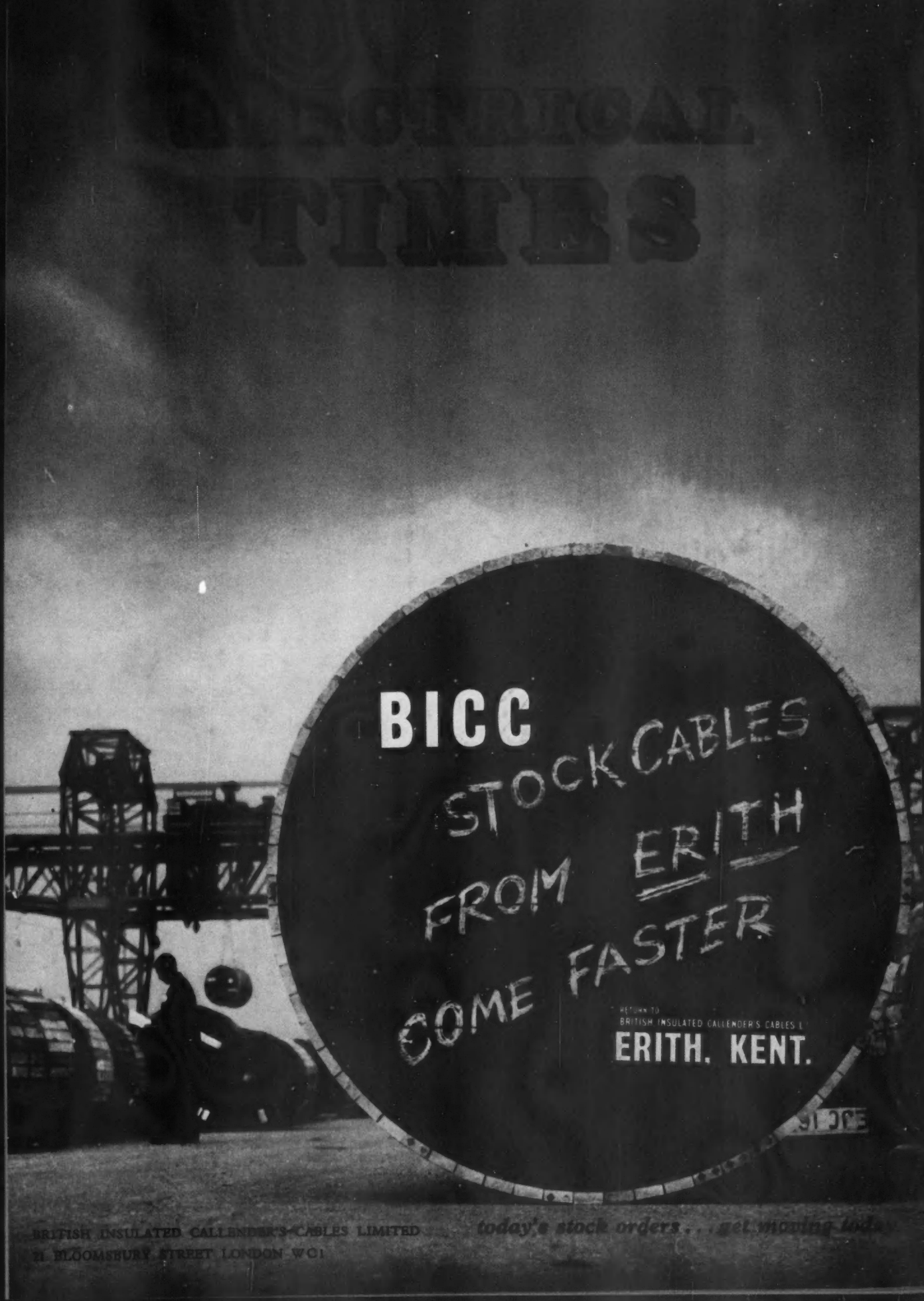
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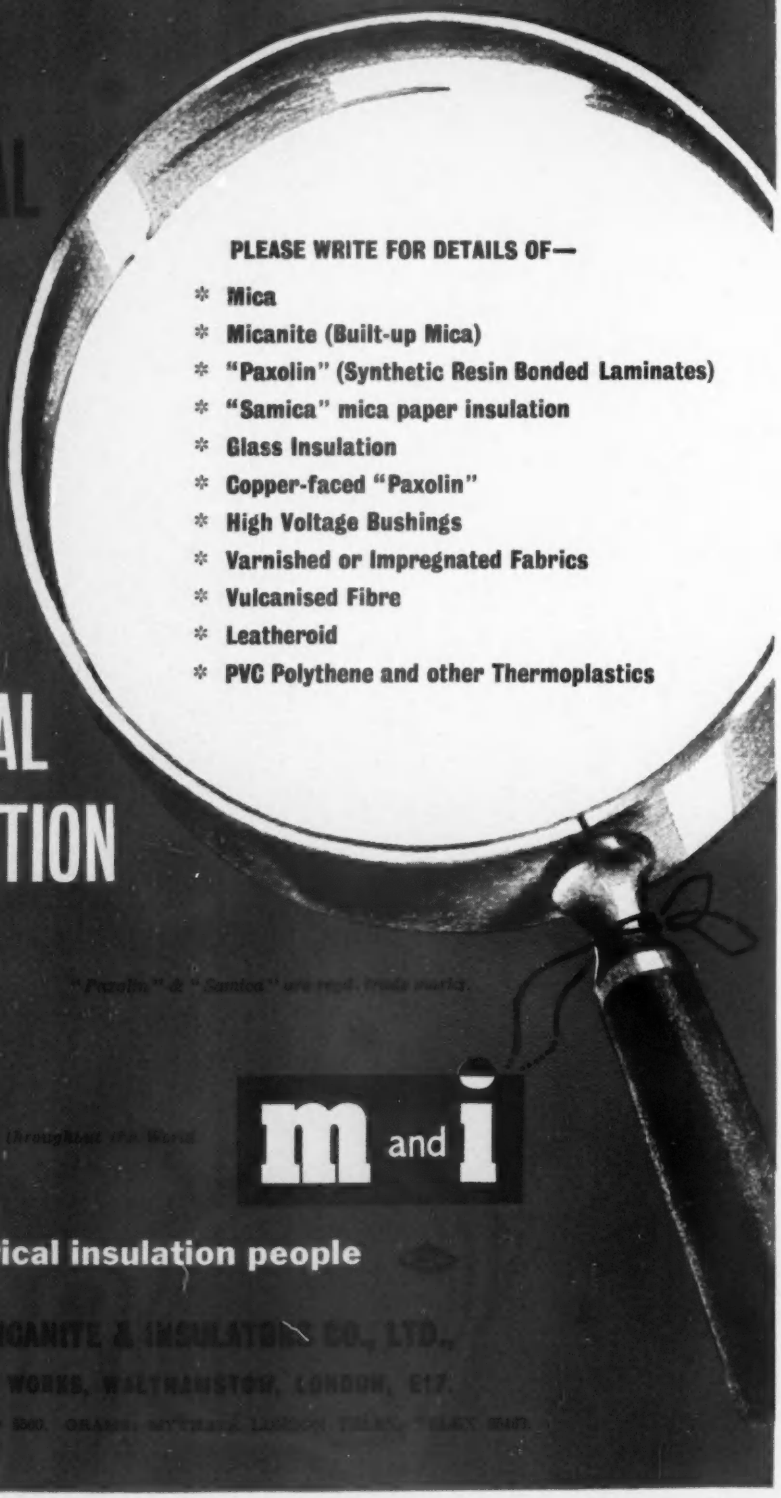

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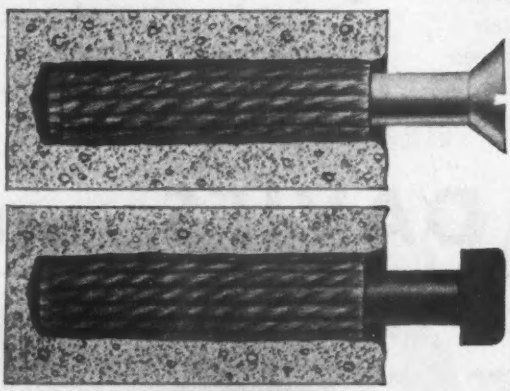

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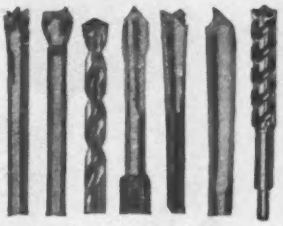

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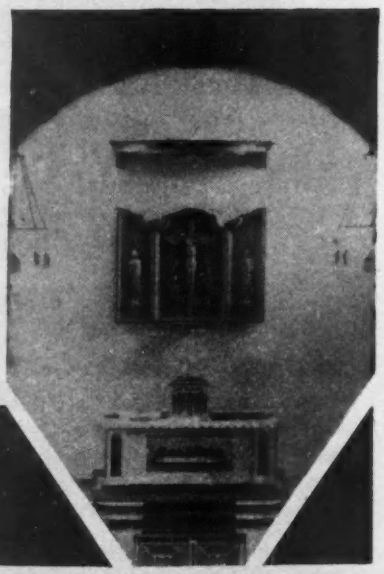

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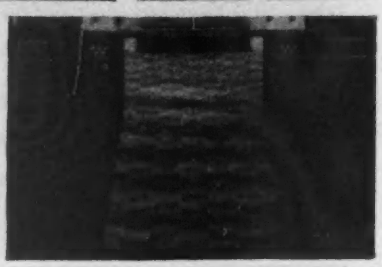

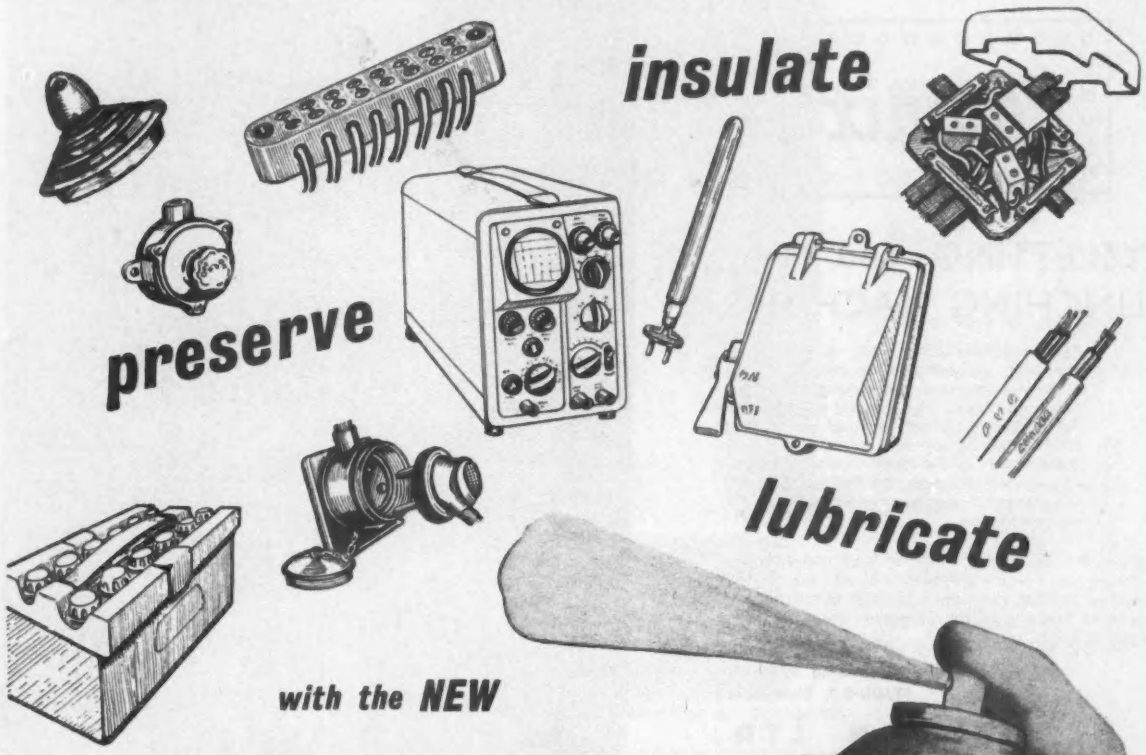

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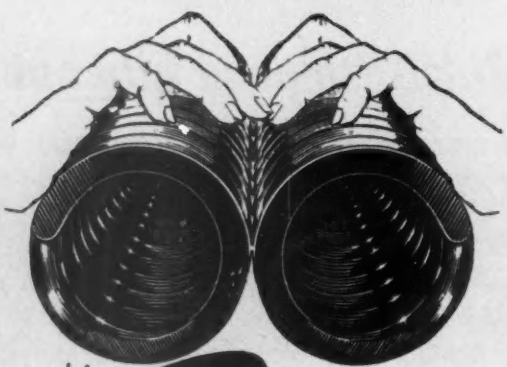

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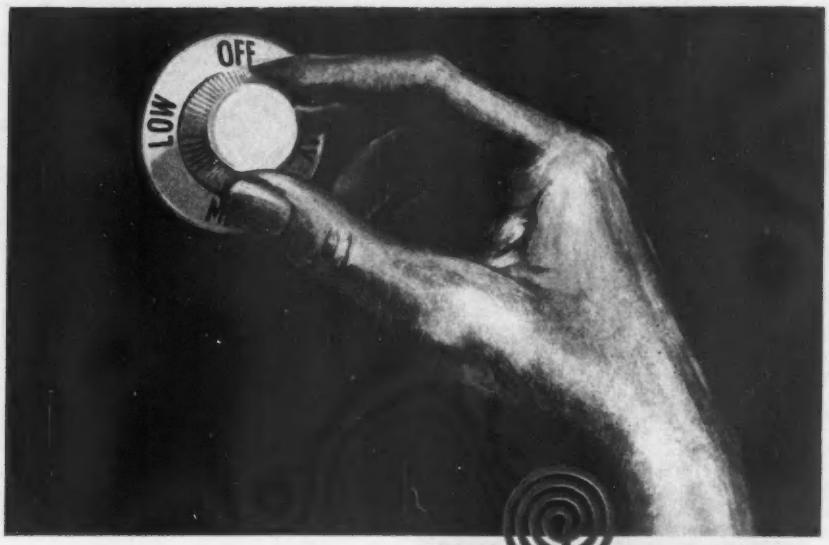

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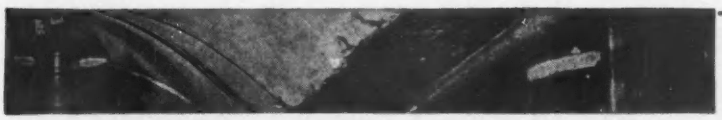

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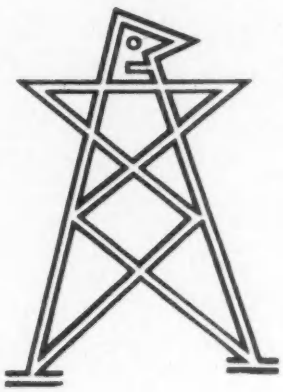

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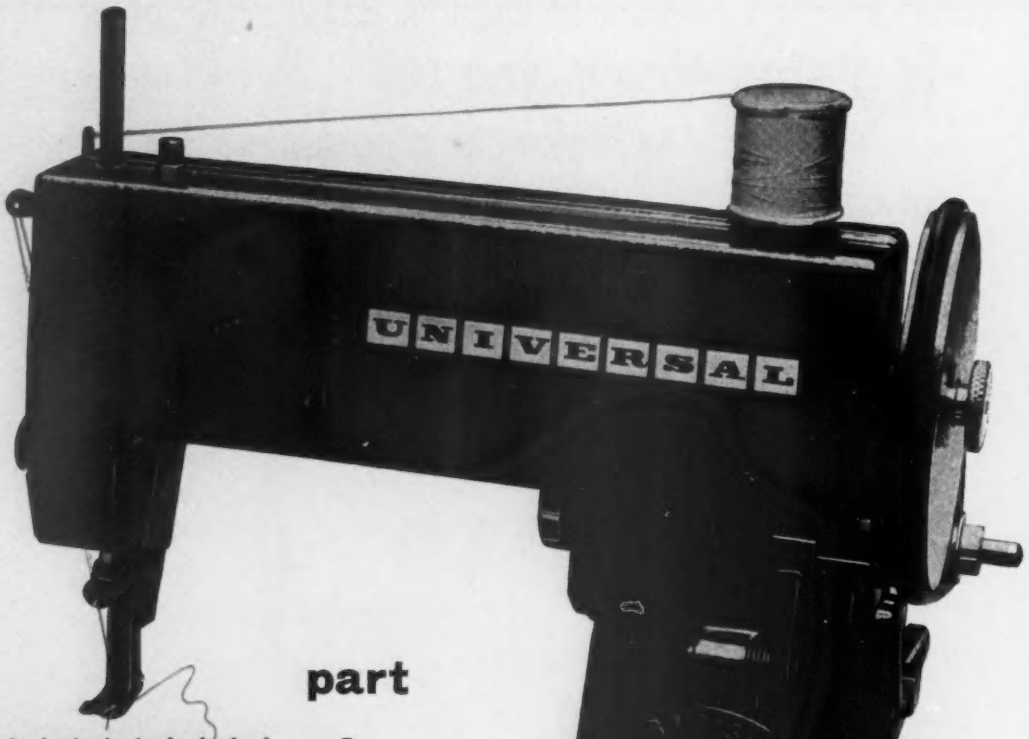

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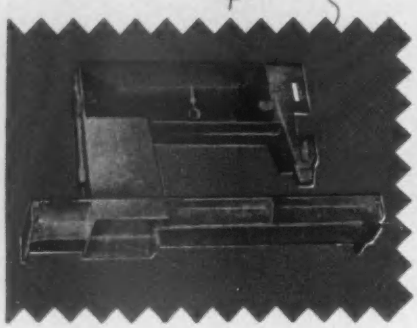

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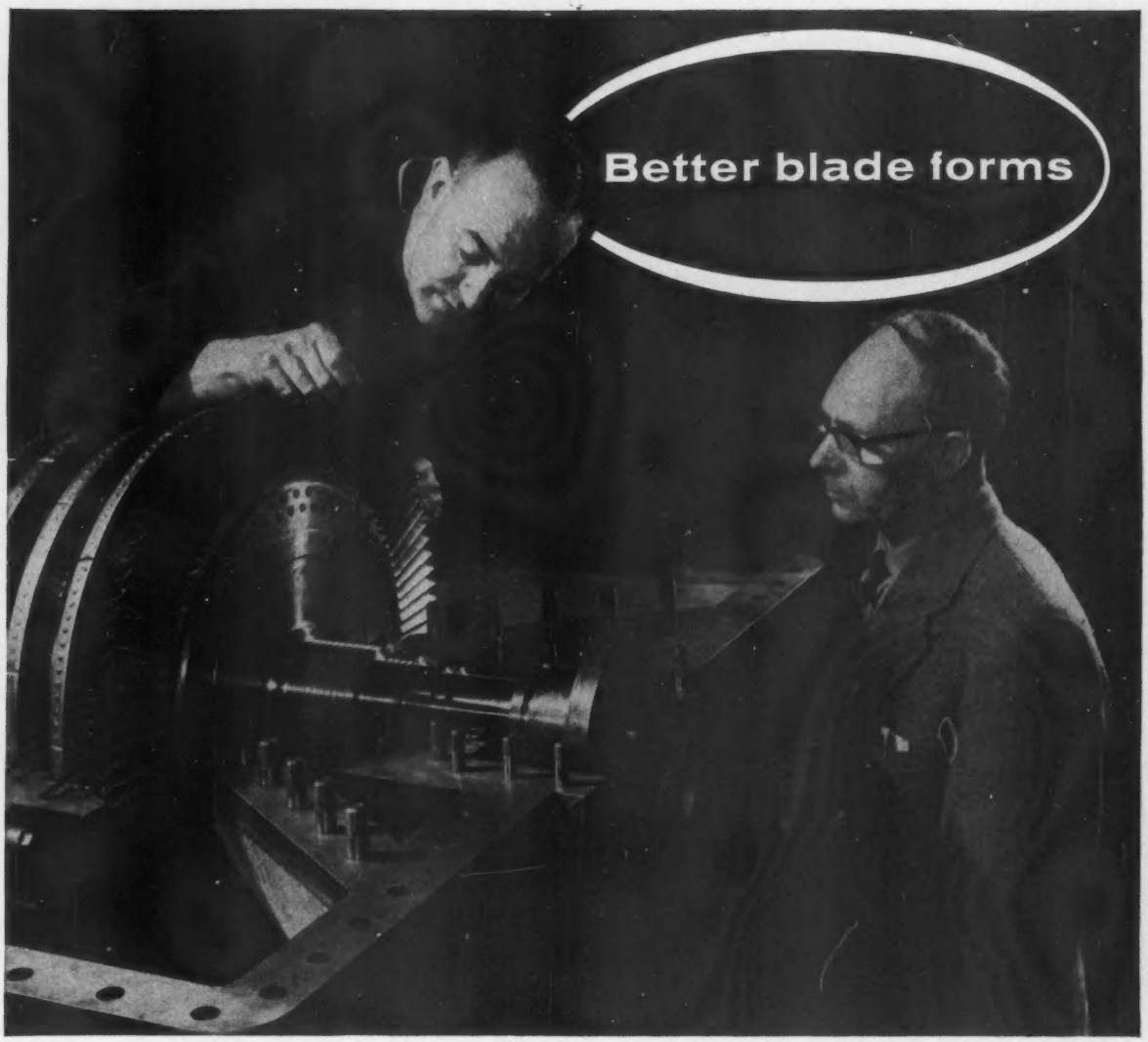

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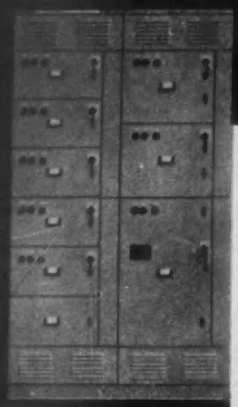

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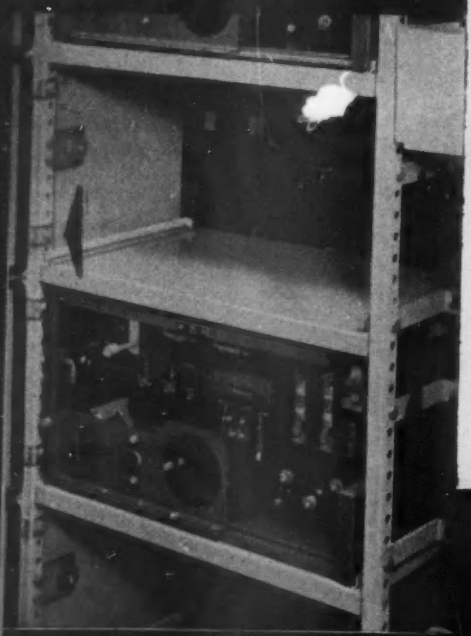

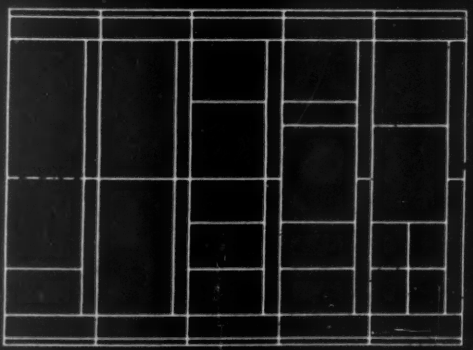

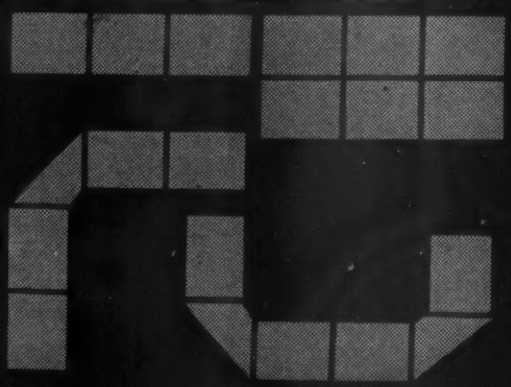

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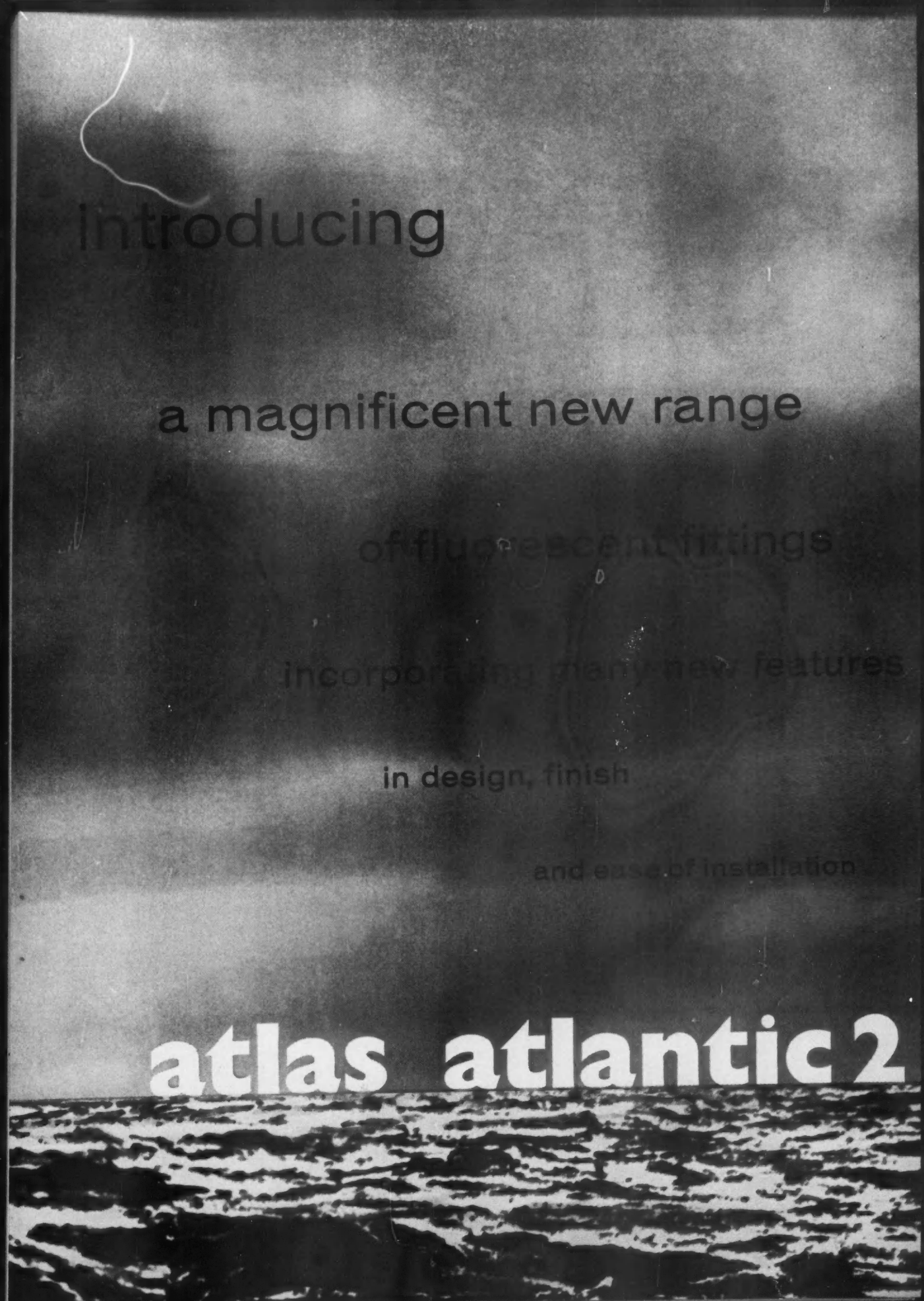
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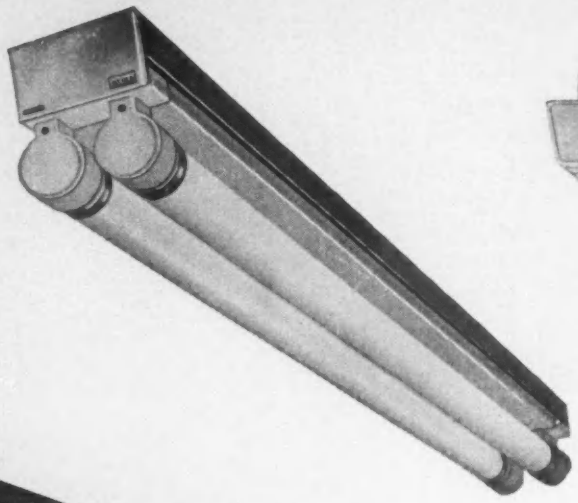
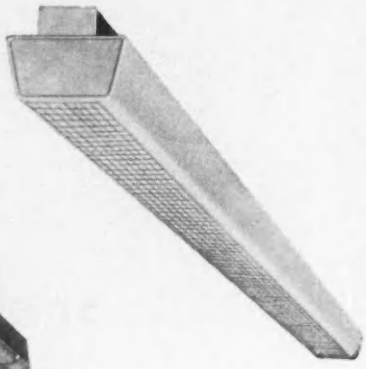
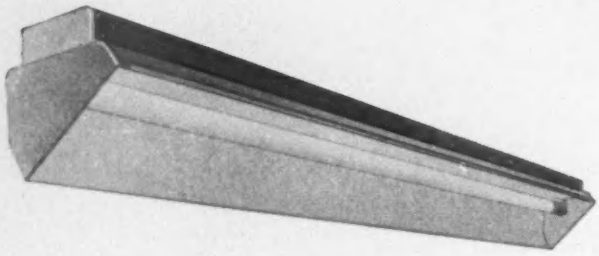
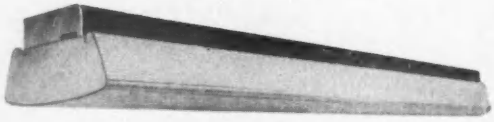
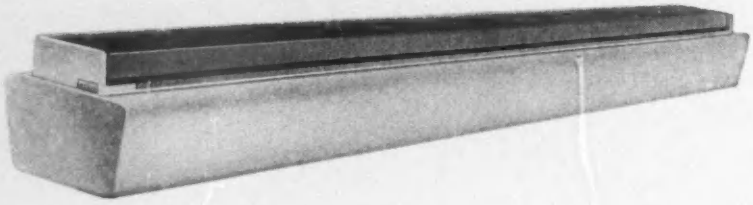
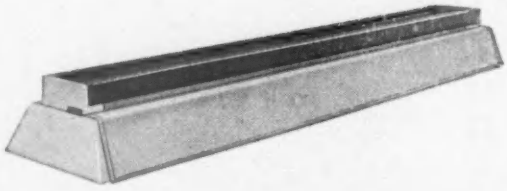


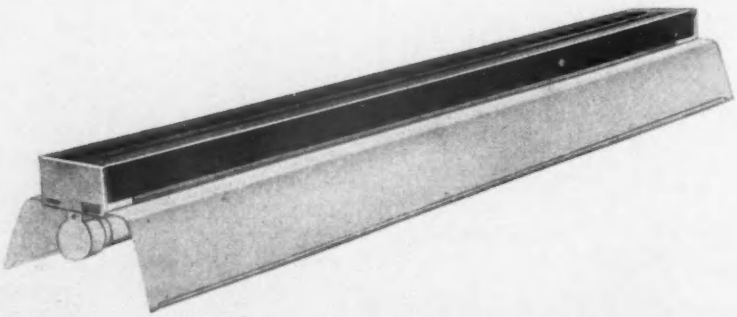


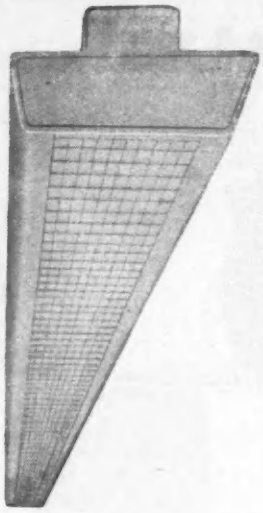


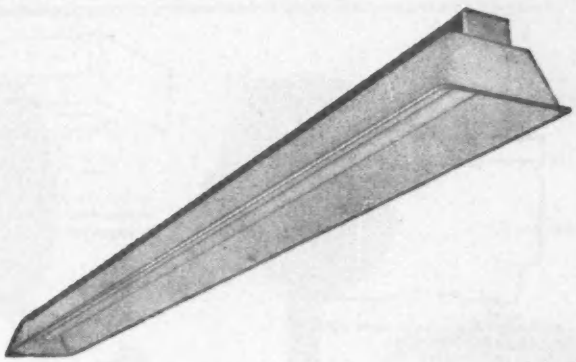


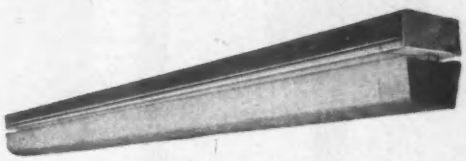






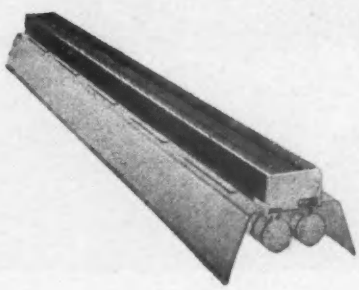


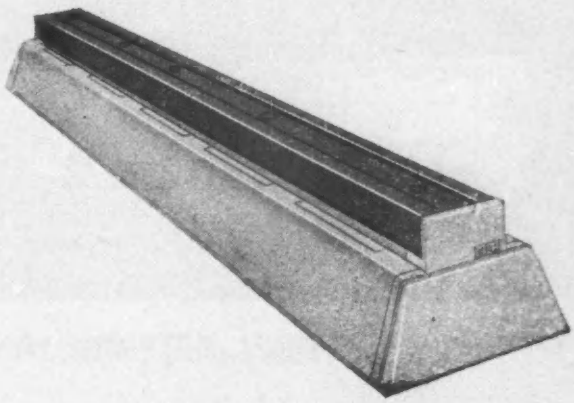




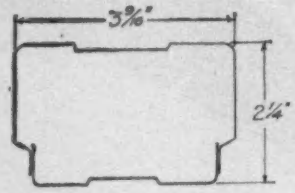
atlas atlantic 2

Here is a new complete family of fluorescent fittings, remarkable for outstanding appearance and a host of features with tremendous appeal on both practical and aesthetic grounds. They are built to the highest quality standards, yet offer surprisingly competitive prices. A unique spine of new slim section provides exceptional ease of installation, simple maintenance and reliability. The flexibility of this range is such that, from the one basic spine using the minimum number of interchangeable components, a wide variety of fluorescent fittings can be created to meet the precise lighting needs of almost any commercial, municipal or industrial premises. Fitting sizes cover 4 ft., 5 ft., and 8 ft., with single or double tubes, a choice of switch-or quickstart control gear, and reflector and diffuser attachments. Included in the range are fittings which accommodate the new Atlas 'Super-8' Circuit. For details of the unique design features of the Atlas Atlantic 2 spine, please see overleaf . . .

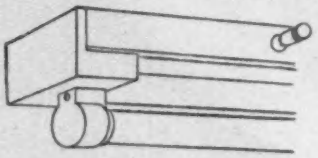




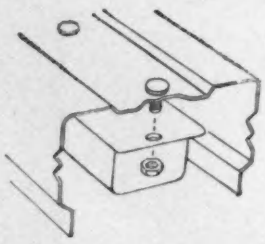
features of the new atlas atlantic 2 spine



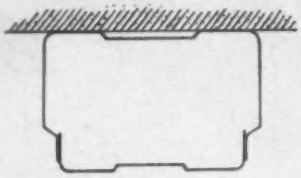
Slimmer section with more pleasing proportions.



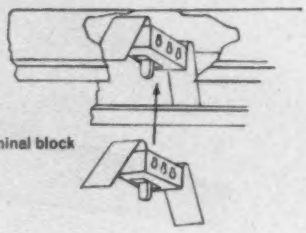
Starter switches replaceable without dismantling. Fixed voltage gear increases reliability.



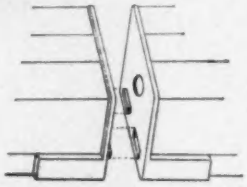
Welded screw studs for easy gear replacement



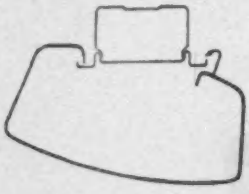
Completely closed back, drip and dust proof. Perfect seating when flush mounted.



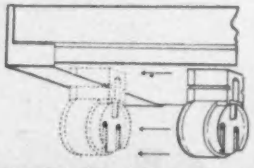
Snap fit terminal block



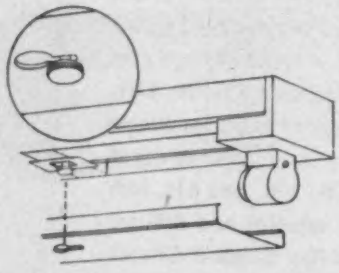
Automatic alignment when mounted in continuous runs. Rugged cast end plates.

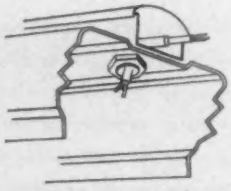


Fast, positive fixing of attachments

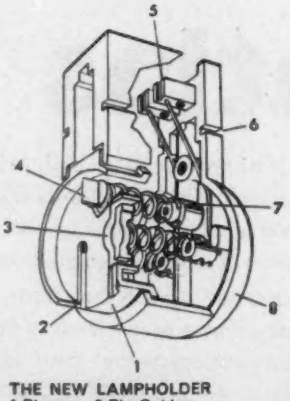


Improved lampholders, need no fixing, no screws





Enclosed through-wiring channels (Optional Extra)



THE NEW LAMPHOLDER
1 Plunger 2 Pin Guides
3 Double finger contacts 4 Earth Contact
5 Terminal connections
6 Lampholder support slots
7 Contact springs 8 Lamp Housing

Single component chassis, pre-wired ready to install. Finest 'Miracryl' finish superior to stove enamels and with advantages over vitreous enamels

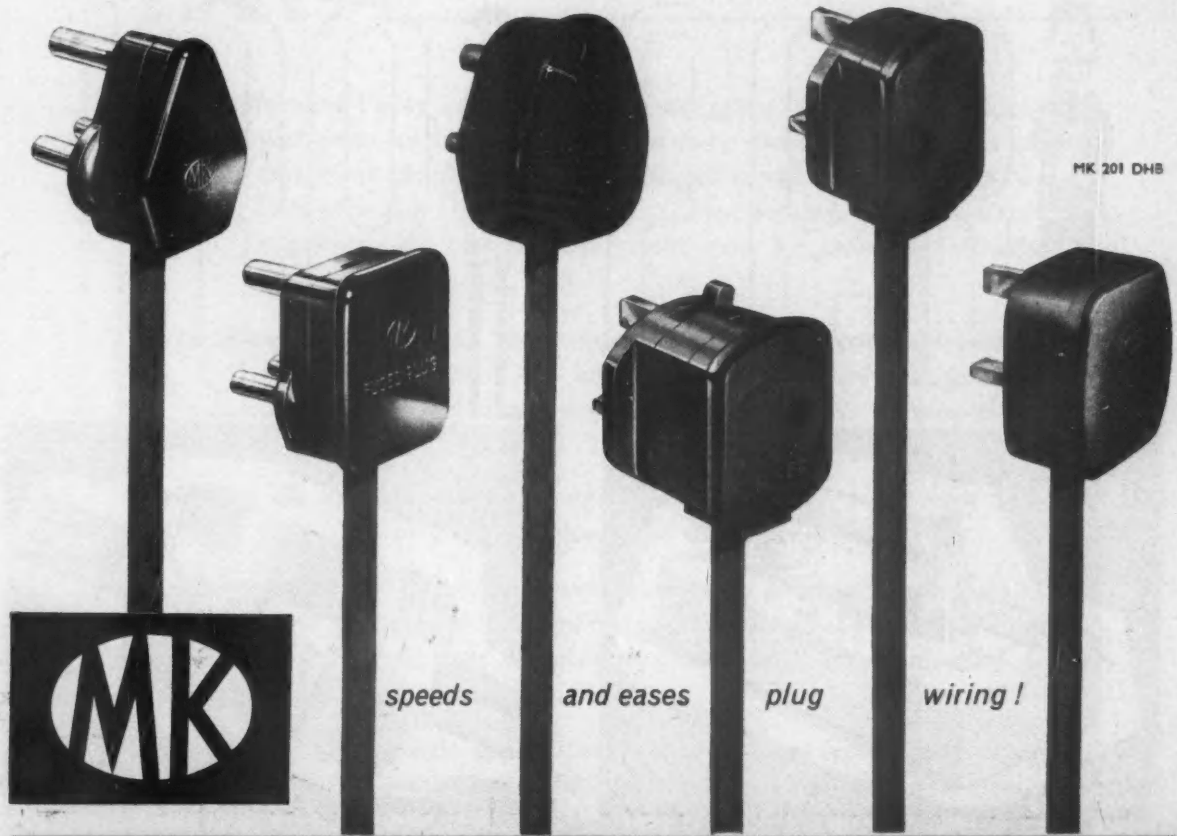
atlas atlantic 2

Complete details of this outstanding new range can be seen in the Atlas Atlantic 2 catalogue, available on request to

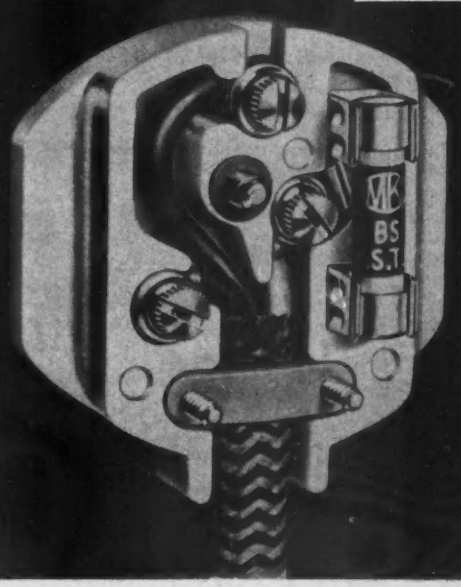
Atlas Lighting Limited, Thorn House, Upper St. Martin's Lane, London, WC2.

DTV

THE *feature which gives leadership in plug design!*



TERMINALS HAVE ROTATING BUT CAPTIVE WASHERS

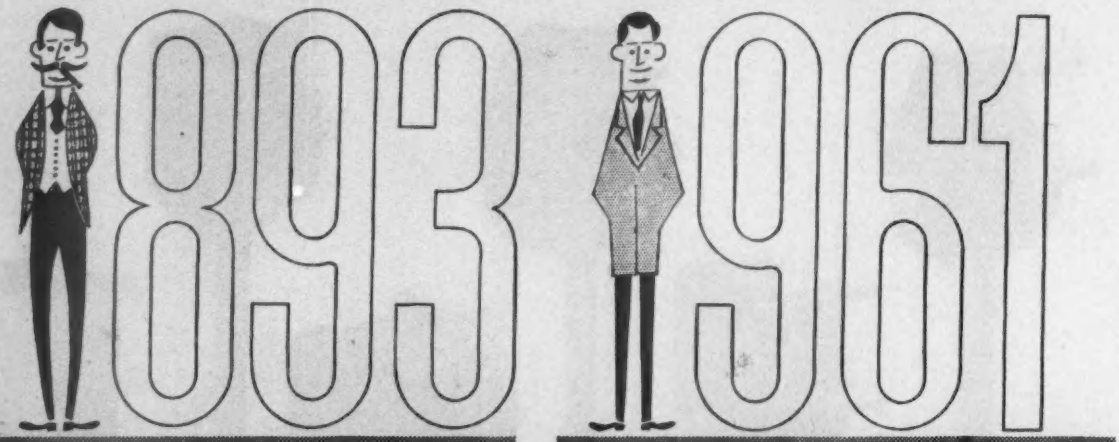


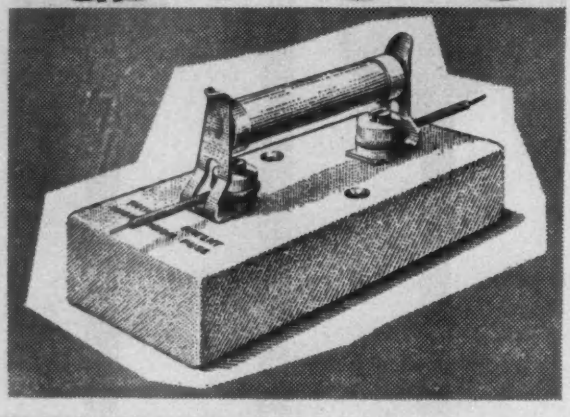
This MK feature (patent applied for) which was introduced during last year to MK 13 amp. rectangular pin plugs has now been extended to MK round pin plugs.

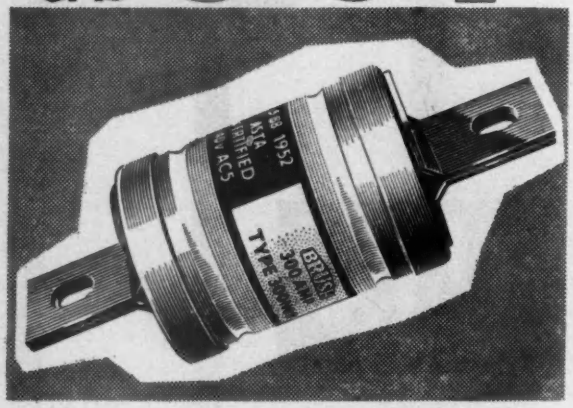
All MK plugs are now quicker and easier to wire. MK wrap-round terminal studs combined with heavy terminal nuts which have captive but rotating washers ensure a secure and efficient electrical connection.

M.K. ELECTRIC LIMITED · SHRUBBERY ROAD · EDMONTON · LONDON N.9 · EDMONTON 5151

Fuse for thought-







BRUSH CARTRIDGE FUSE-LINKS—

The H.T. fuse above, was invented by a Mr. Mordy and introduced by The Brush Company in 1893. Since that time, as distribution systems expanded, the problem of providing fault protection at low voltage has involved designing a more ingenious device! To-day, high breaking Capacity Fuse-Links by Brush incorporate these advantages:

* *The high speed of operation ensures that heavy fault currents are cut off before peak values are reached and the stresses on equipment are thus reduced to a safe figure.*

* *The characteristics of the fuse-links are unaffected by extremely long periods of use at normal current rating due to the careful design of the elements.*

* *Deterioration of the fuse element is prevented by complete enclosure.*

* *There is no external arc or disturbance during operation and arc voltage rise is restricted.*

* *They are compact and inexpensive and may be used to give protection to existing equipment of low breaking capacity, thus avoiding costly replacement.*

* *They are accurately calibrated and give reliable discrimination between themselves and with other protective devices.*

Brush CARTRIDGE FUSE-LINKS for industry 2—800 amperes

Inter-service-½ ampere-150 amperes. House Service Cut-out 5-100 amperes. The full range A.S.T.A. Certified to BS 88/1952

A.S.E.E. EXHIBITION
EARLS COURT
MARCH 21—25

BRUSH

VISIT US ON STAND
No. C6

BRUSH ELECTRICAL ENGINEERING CO. LTD · LOUGHBOROUGH · ENGLAND

A member of the Hawker Siddeley Group

NEWS SHEET

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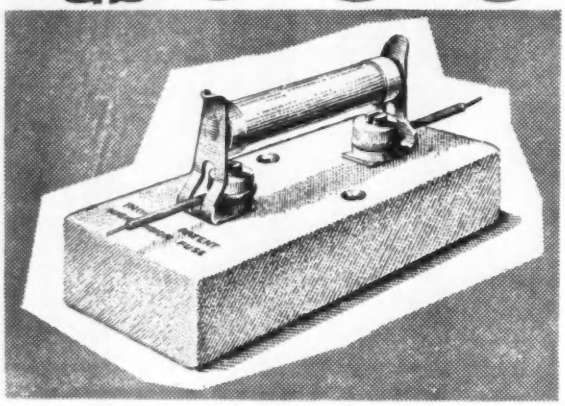
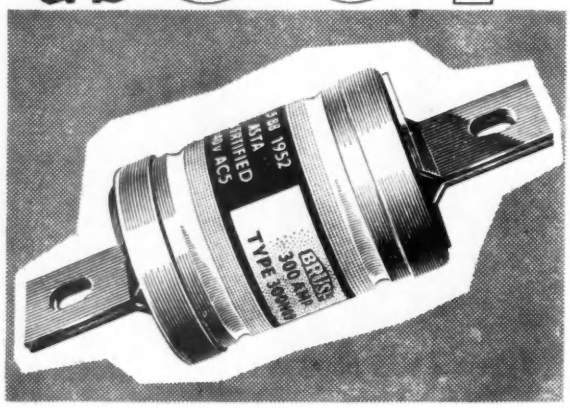
Fuse for thought-

1893

1961





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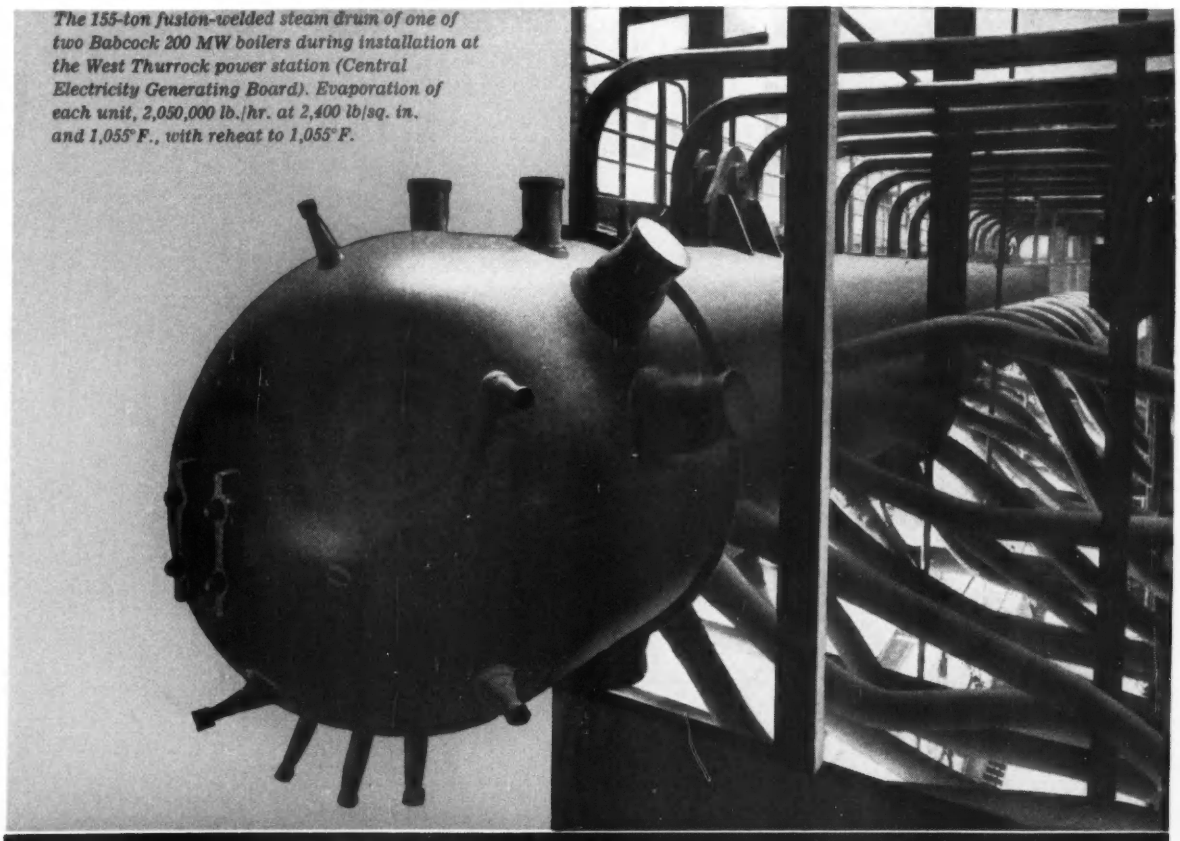
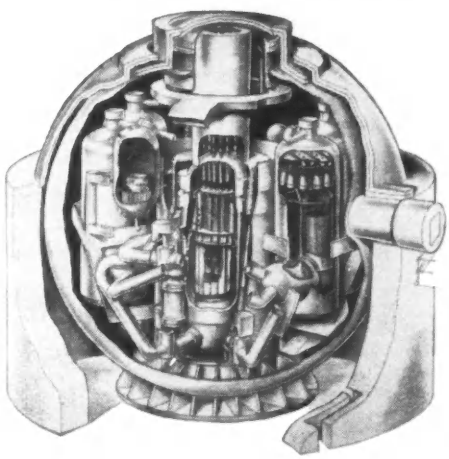


The 155-ton fusion-welded steam drum of one of two Babcock 200 MW boilers during installation at the West Thurrock power station (Central Electricity Generating Board). Evaporation of each unit, 2,050,000 lb./hr. at 2,400 lb/sq. in. and 1,055°F., with reheat to 1,055°F.

The age of STEAM

This is the age of *steam*. For some it may be the electrical age. For others, the atomic age. But nearly all our electrical power is *steam*-generated—over 98% of it, in Britain, and over 80% of it throughout the world; and atomic power is available in useful form only through the medium of *steam*.

Steam has marched with the times. And the times have marched with steam; because progress in power generation—to the present stage of a single boiler to drive a 550 MW set or to operate at supercritical pressures, with central-station thermal efficiencies of the order of 40%—has followed the path of advancing *steam* technology and engineering.



Cut-away view of a Babcock water-cooled nuclear reactor and steam-raising equipment, with an evaporation of 615,000 lb. of steam/hr., for nuclear ship propulsion; also applicable to electrical-power generation.

BABCOCK

STEAM-RAISING PLANT

BABCOCK & WILCOX LTD. BABCOCK HOUSE, 209 EUSTON ROAD, LONDON N.W.1

C

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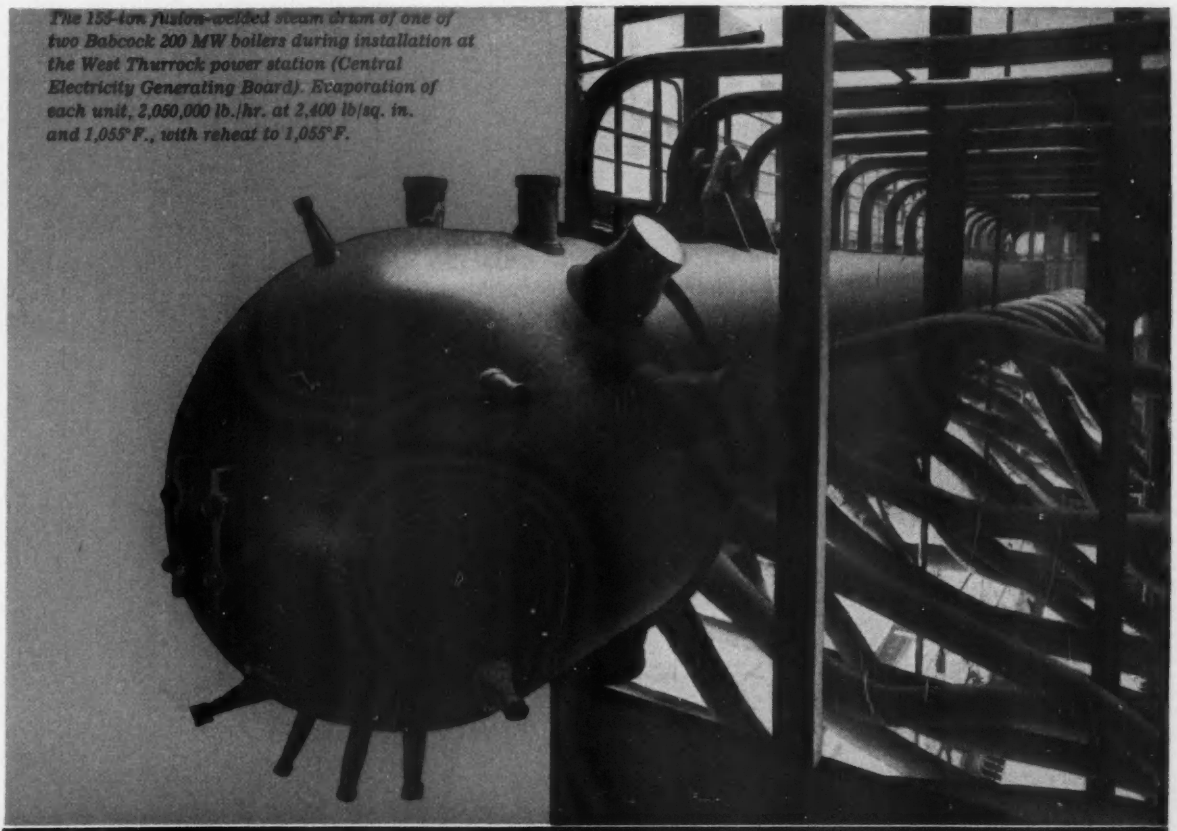
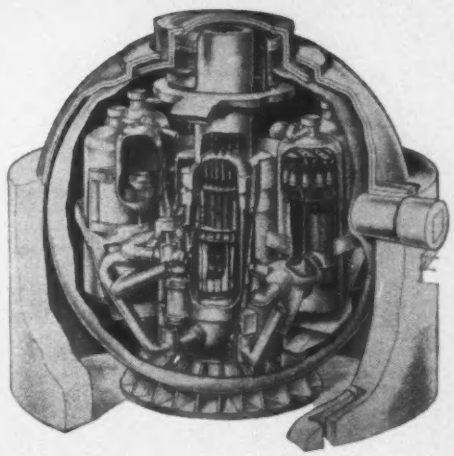


The 155-ton fusion-welded steam drum of one of two Babcock 200 MW boilers during installation at the West Thurrock power station (Central Electricity Generating Board). Evaporation of each unit, 2,050,000 lb./hr. at 2,400 lb/sq. in. and 1,055°F., with reheat to 1,055°F.

The age of STEAM

This is the age of *steam*. For some it may be the electrical age. For others, the atomic age. But nearly all our electrical power is *steam*-generated—over 98% of it, in Britain, and over 80% of it throughout the world; and atomic power is available in useful form only through the medium of *steam*.

Steam has marched with the times. And the times have marched with steam; because progress in power generation—to the present stage of a single boiler to drive a 550 MW set or to operate at supercritical pressures, with central-station thermal efficiencies of the order of 40%—has followed the path of advancing *steam* technology and engineering.



Cut-away view of a Babcock water-cooled nuclear reactor and steam-raising equipment, with an evaporation of 615,000 lb. of steam/hr., for nuclear ship propulsion; also applicable to electrical-power generation.

BABCOCK

STEAM-RAISING PLANT

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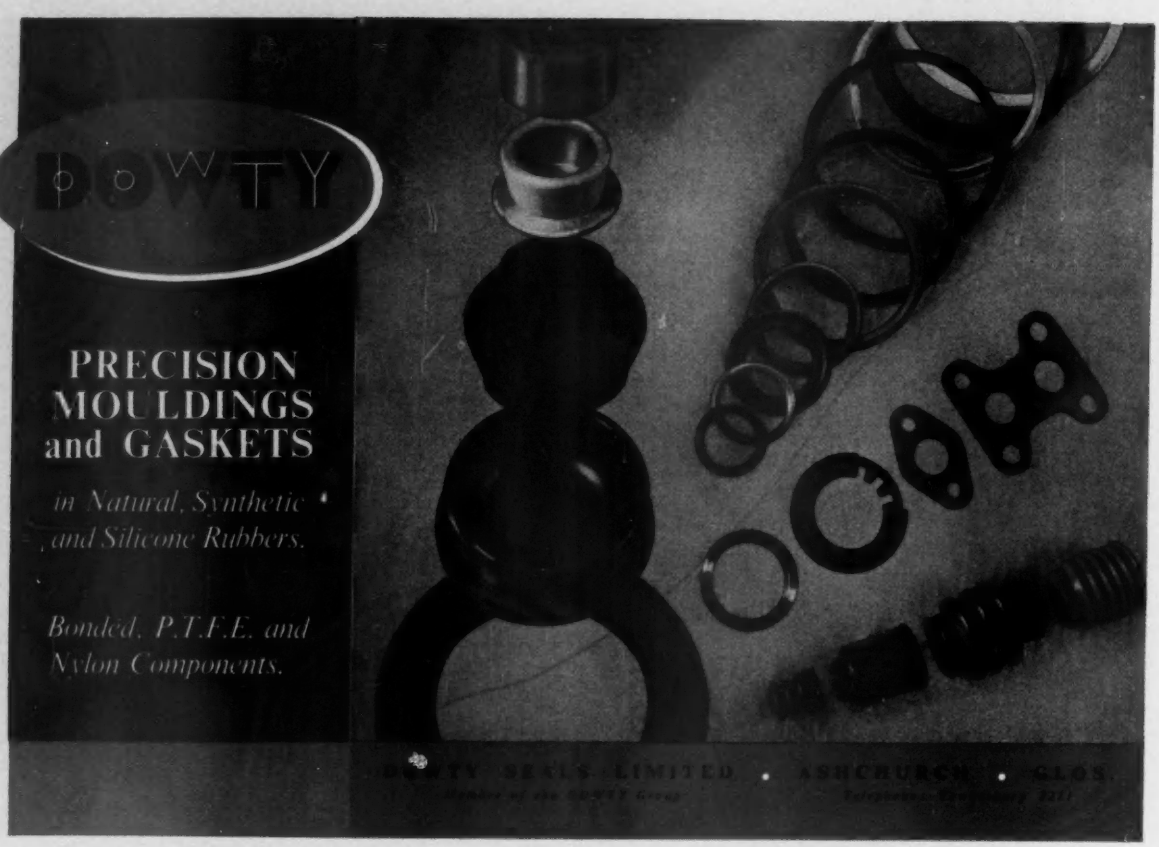

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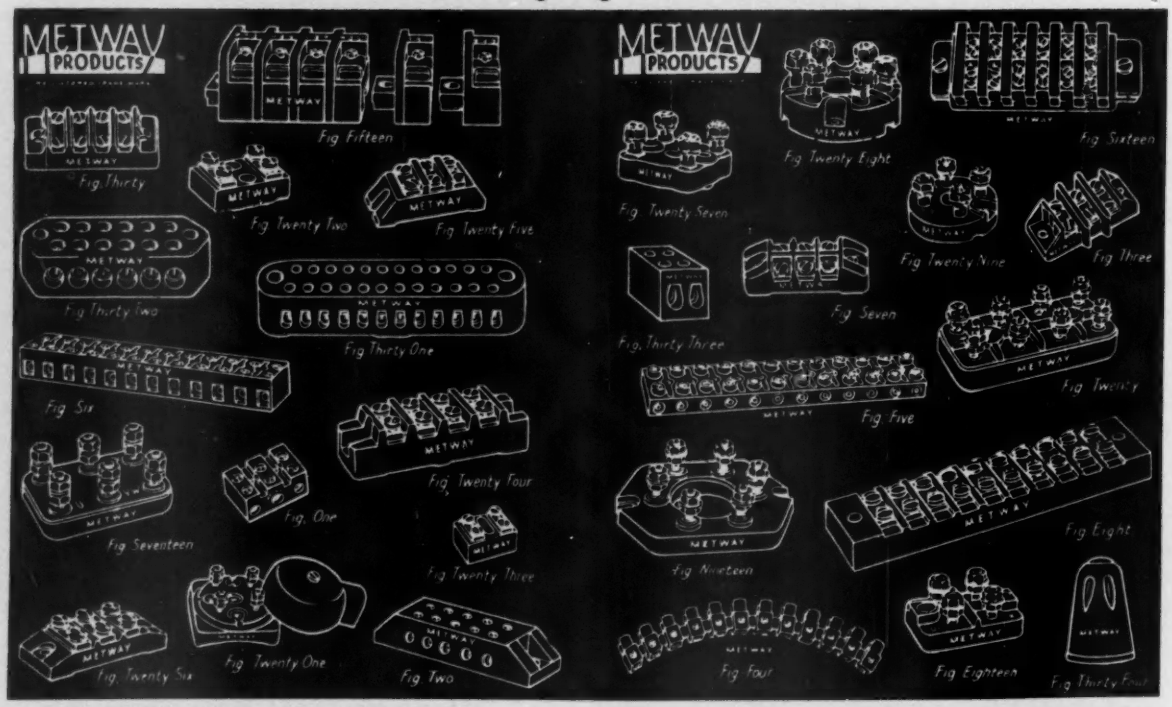
at **EARLS COURT** MARCH 21st-25th. Visit our **STAND No. N. 12** and see
our ever increasing range of terminal blocks



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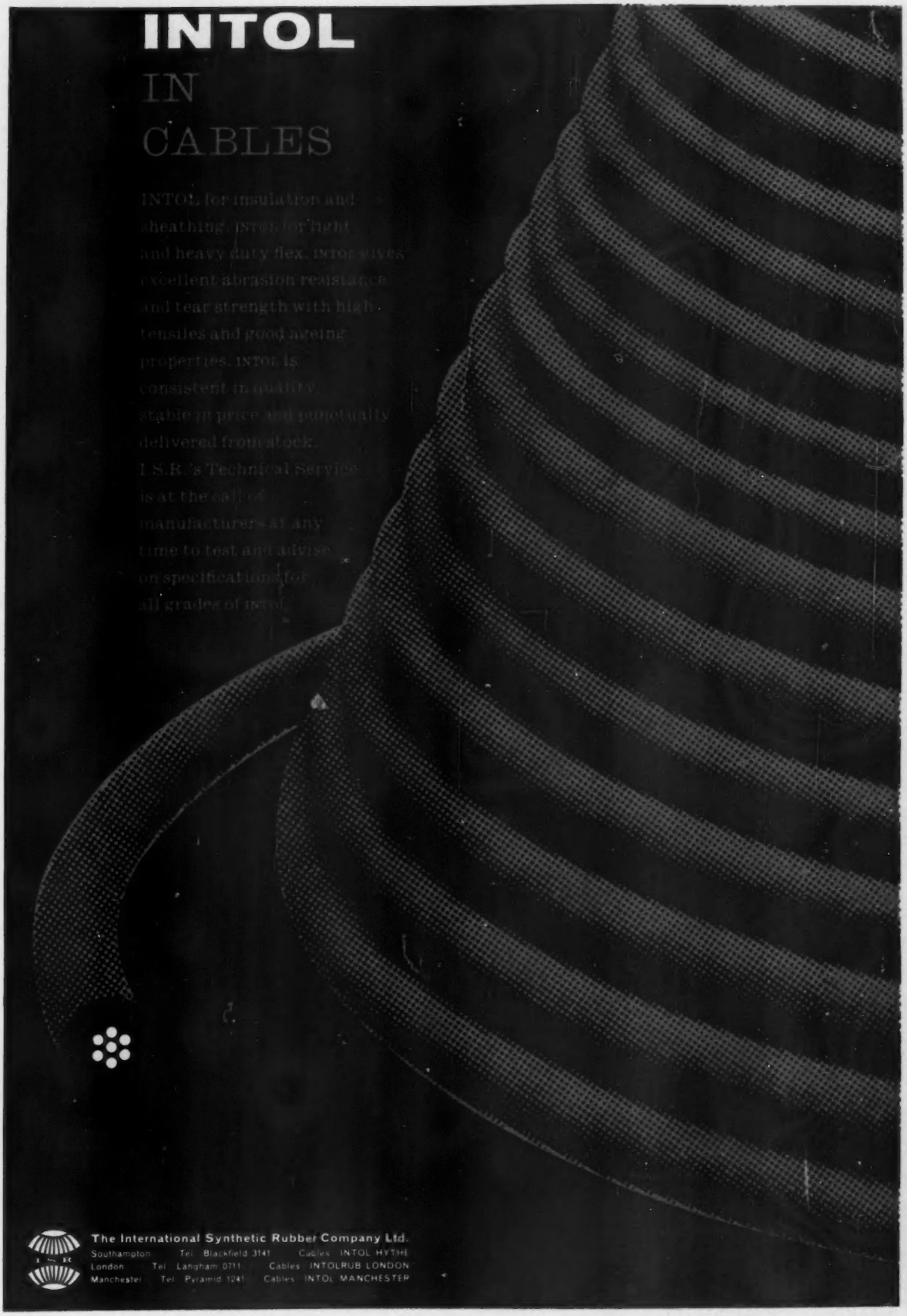

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for squirrel-cage motors up to 7½h.p. 380V...

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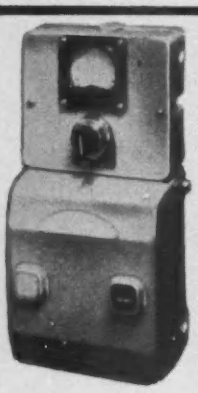
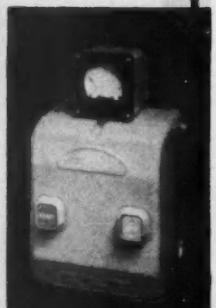
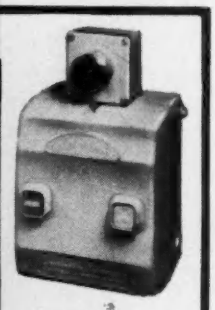
in both simple and comprehensive forms



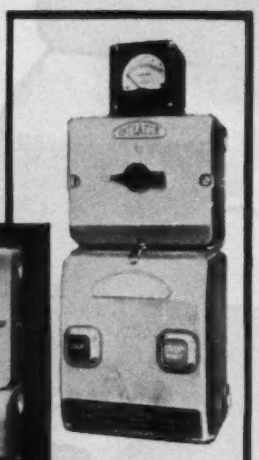
Routine maintenance, or full servicing, with a screwdriver alone in a matter of minutes



Both its lift-out mechanism and its case are firmly mounted with the minimum of fixing screws

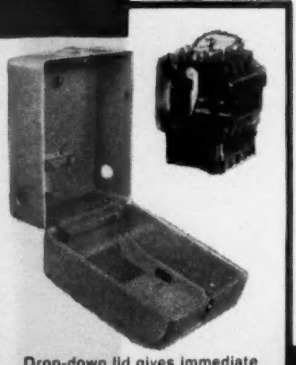


Vertical, dust safe contacts and small-mass moving parts for great electrical and mechanical service life

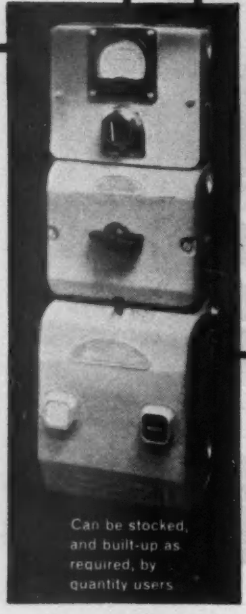


Easy wiring with ample cable knockouts top and bottom

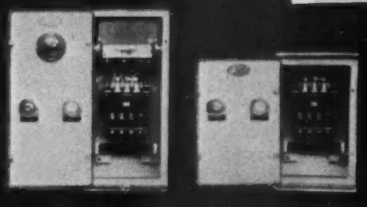
This die-cast alloy simple starter is in stock at our Chester Works in many commonly required arrangements. It occupies less than one-tenth of one cubic foot



Drop-down lid gives immediate access to interior



Can be stocked, and built-up as required, by quantity users



The sheet steel comprehensive model is rubber gasketed for dust and damp protection *as standard*. It is *in stock* at our Chester Works in all the commonly required arrangements, including reversing

Write for details of these quick-delivery across-the-line starters

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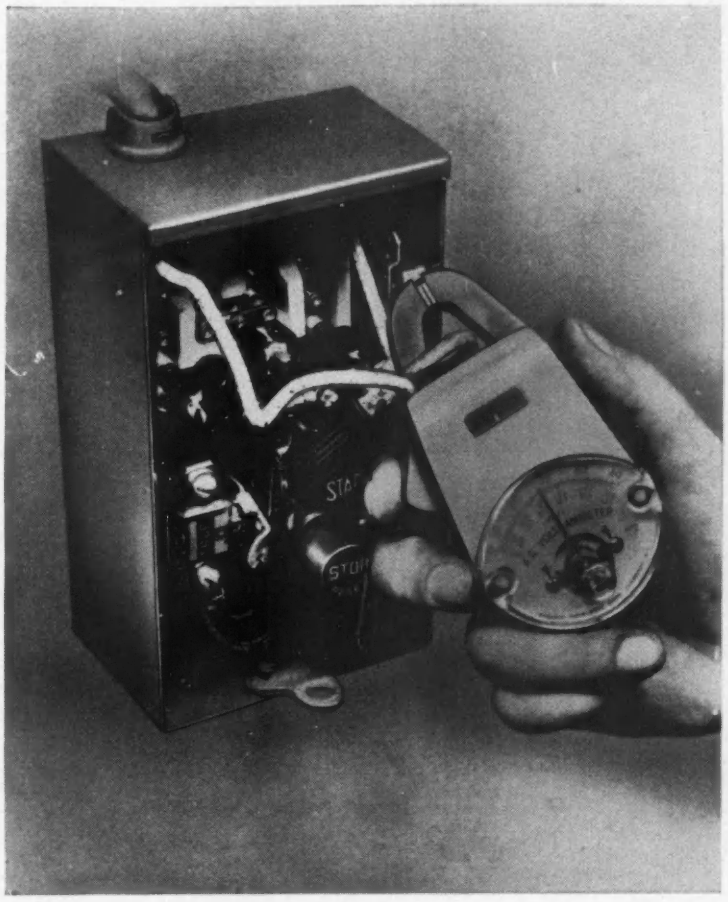
Works at: **CHESTER & BEDFORD**

Makers of Britain's widest range of electrical control and associated equipment.

BI/48

Metal Industries Group



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AMPROBE JR.

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Does it measure current as well as voltage?	YES	NO
Does it give you full visibility on a graduated reading scale?	YES	NO
Does it fit conveniently in your pocket?	YES	YES
Does it measure within ±3% accuracy?	YES	NO
Does it come in a full line of models to meet different problems?	YES	NO
Does it protect you against shorts and shocks?	YES	YES
Does it balance loads, locate earths, determine motor overloads, check rating of circuit breakers?	YES	NO

AS A VOLTAGE TESTER: for checking critical operating voltages.

AS AN AMMETER (large photo): reading current at switch box.

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H. J. BALDWIN & COMPANY LTD VICTORIA MILLS, GAMBLE ST., NOTTINGHAM

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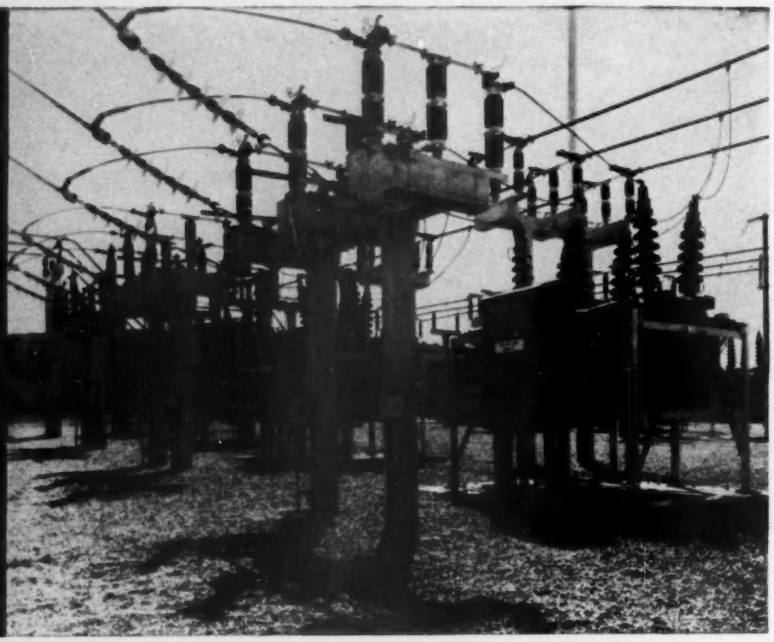
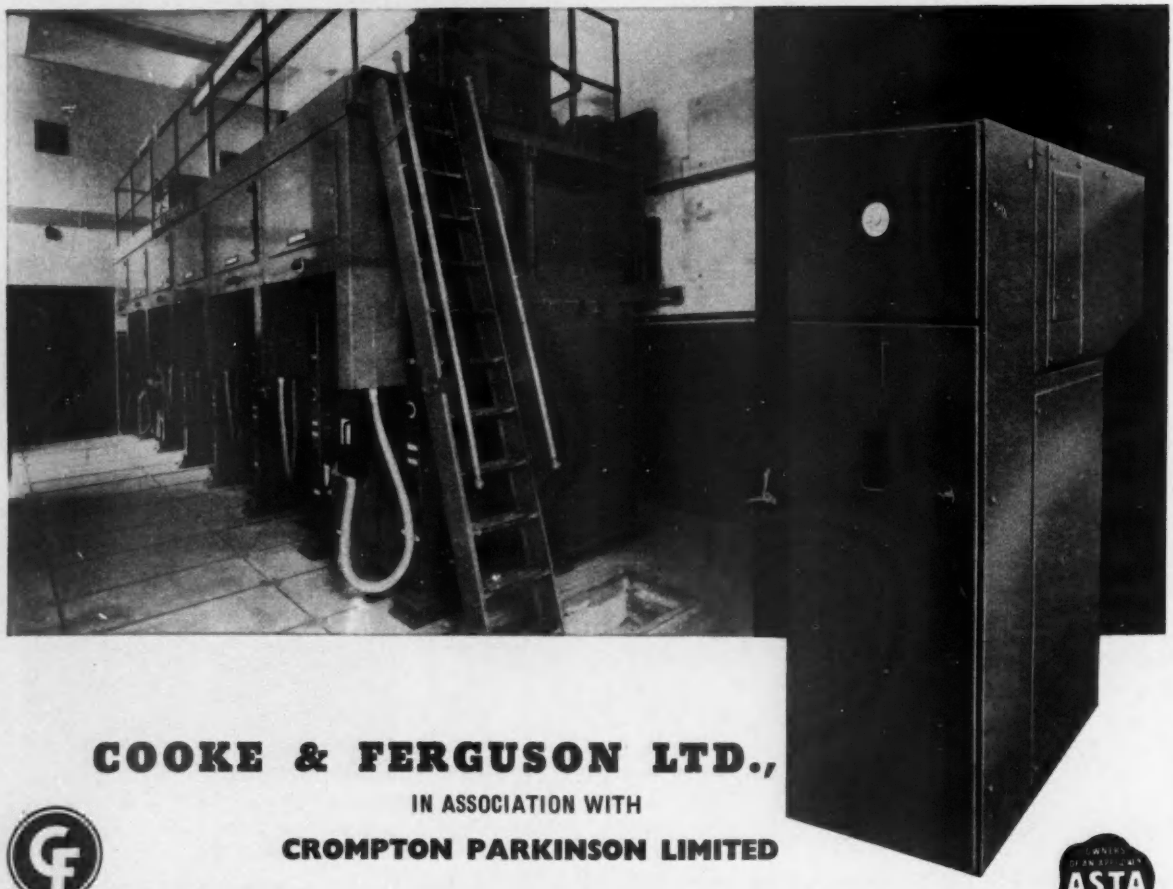


... up to and including 66kV



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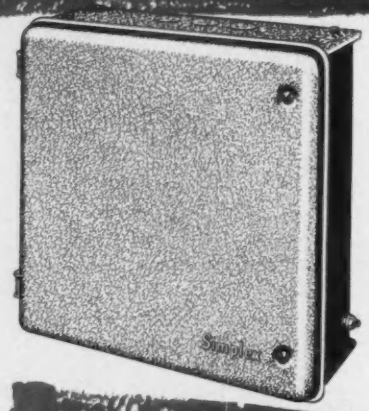
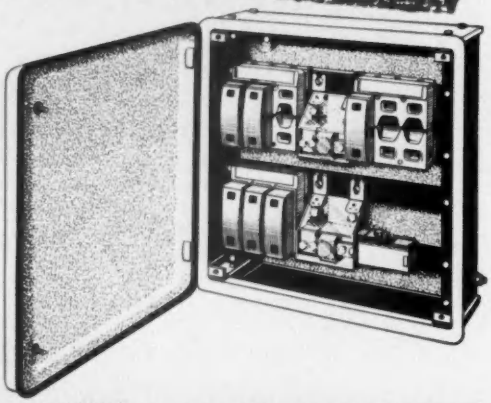
DISTRIBUTION FUSEBOARDS

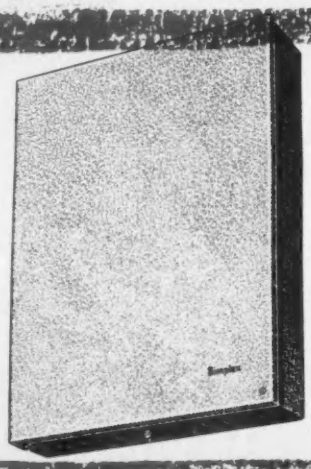
Simplex Star "dead-front" Distribution Fuseboards are: low in price · easy to wire · completely safe because all live parts are shrouded, even with the fuses removed. There is provision for: circuit indentification on the fuse bank and neutral connections · surface or flush mountings, Ratings — 15, 30 or 60 amp, 500 volt A.C. or 250 volt D.C. Star Economy Distribution Fuseboards offer the same advantages as the Star Distribution Boards at the lowest possible price. More details of Simplex Star Distribution Fuseboards available on request.



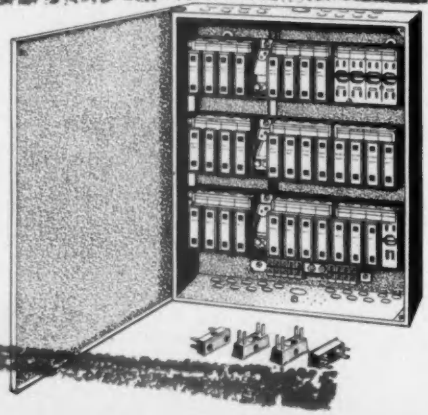
Star Distribution Fuseboard. Neat appearance. Strong All-Steel case.



Star Distribution Fuseboard with cover open; some fuses are removed to show dead-front feature.



Star Economy Distribution Fuseboard.



Star Economy Distribution Fuseboard with cover open showing shields, and dead-front feature when fuses are removed.

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CREDA WORKS, BLYTHE BRIDGE
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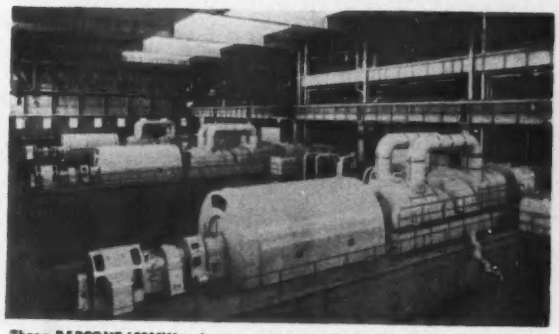
Branches throughout Britain and Agents throughout the World

ELECTRICAL DIVISION

Photo: Holloways Scottish Constructions Ltd.

OFFICIALLY OPENED on October 12th 1960 Kincardine Power Station, on the River Forth, with an installed capacity of 360MW (to be increased to 760MW by 1963) is the largest power station owned by the South of Scotland Electricity Board.

The three PARSONS 120MW turbo-generators now installed operate with steam at 1,500 psig. and 1,000°F with reheat to 1,000°F.

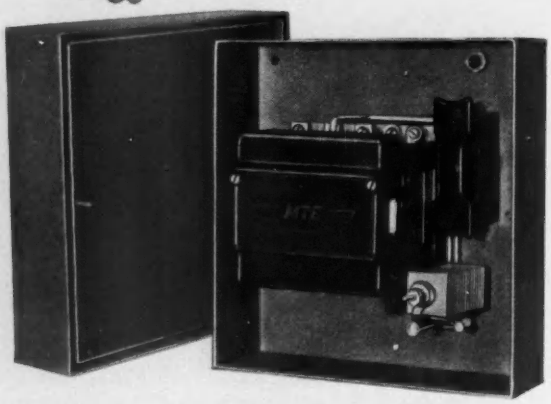


Three PARSONS 120MW turbo-generators installed at Kincardine Power Station

PARSONS turbo-generators

C. A. PARSONS & CO. LTD · HEATON WORKS · NEWCASTLE UPON TYNE

You asked for it



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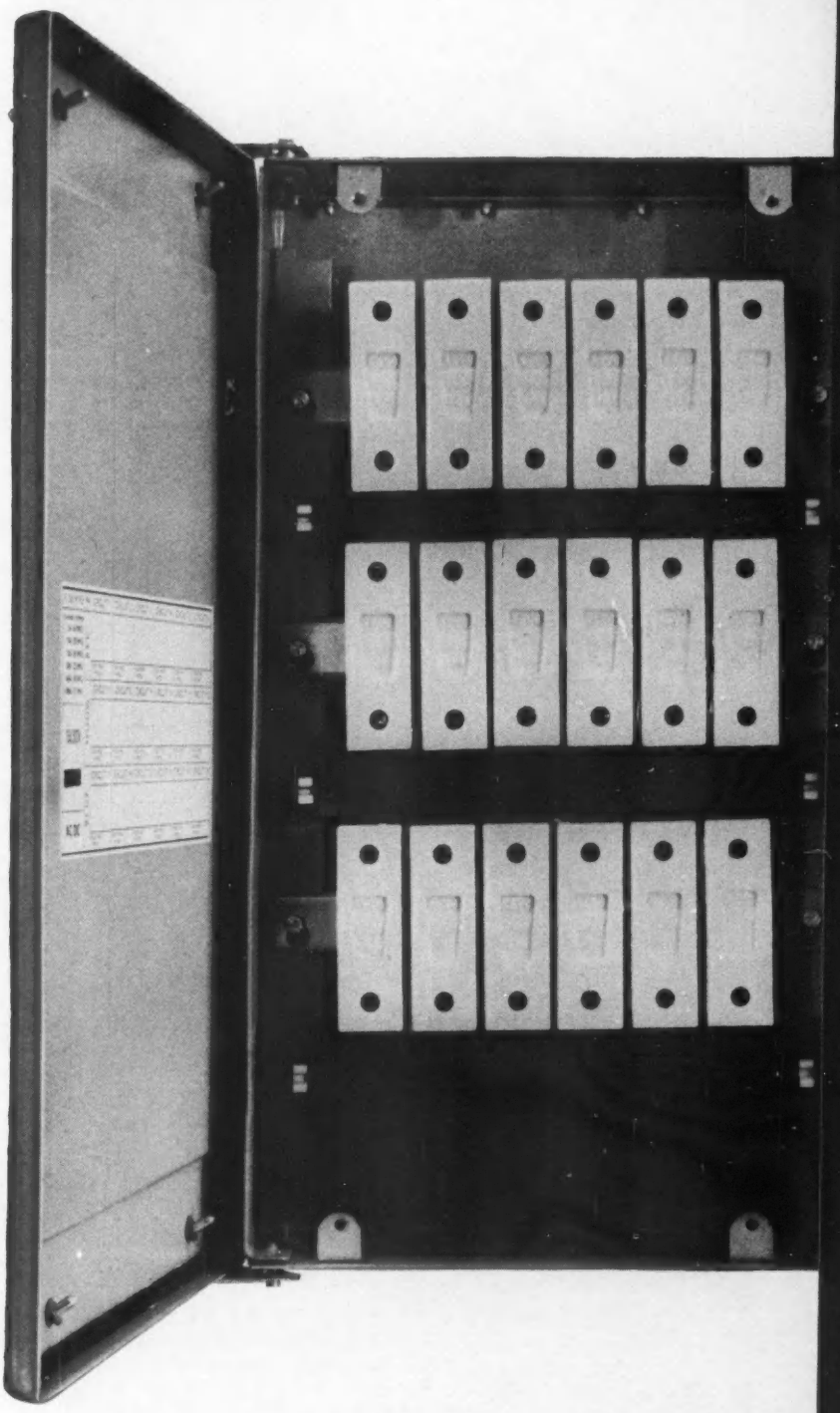

. . . Safeway Distribution Boards are modern, lightweight and soundly built for easier wiring facilities with ample wiring space. Fully comprehensive range in 15, 30, 60 and 100 amp capacities, with rewireable or H R C fuse carriers, is detailed in our Switch and Fusegear catalogue. May we send you one?

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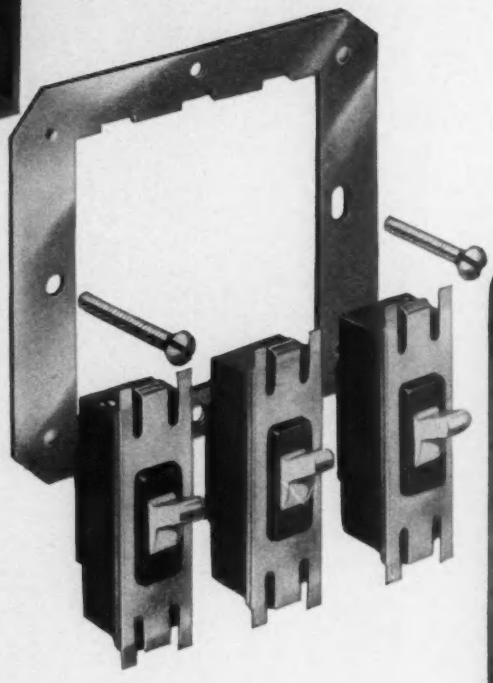
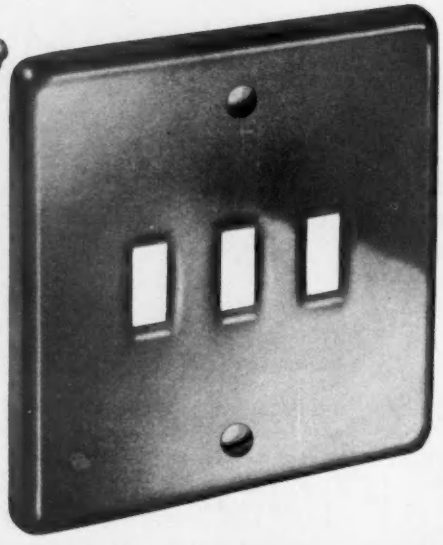
you can put up to 3 switches in a BS 1299 1-GANG BOX with **'MUTAC CLIPPER'** switch assemblies





Three into one does go, safely, compactly and swiftly, when you use 'Mutac Clipper' switch assemblies and a standard B.S.1299 box. And now all the proven 'Mutac Clipper' advantages—simplified installation, time saved, reduced costs, are available in types and sizes to cover every normal switching requirement. The chart below gives full details and a useful switch selector, available freely on request, makes ordering simple too.

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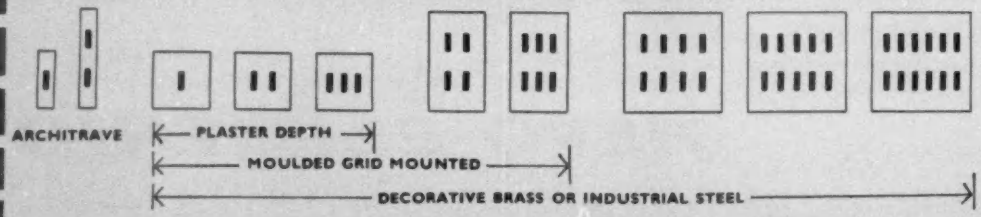

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5 amp 1 way S.P.
15 amp 1 way S.P.
5 amp 1 way D.P.
5 amp 2 way S.P.
5 amp 2 way & Off
5 amp intermediate
5 amp 1 way secret
5 amp 2 way secret

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switchfuses

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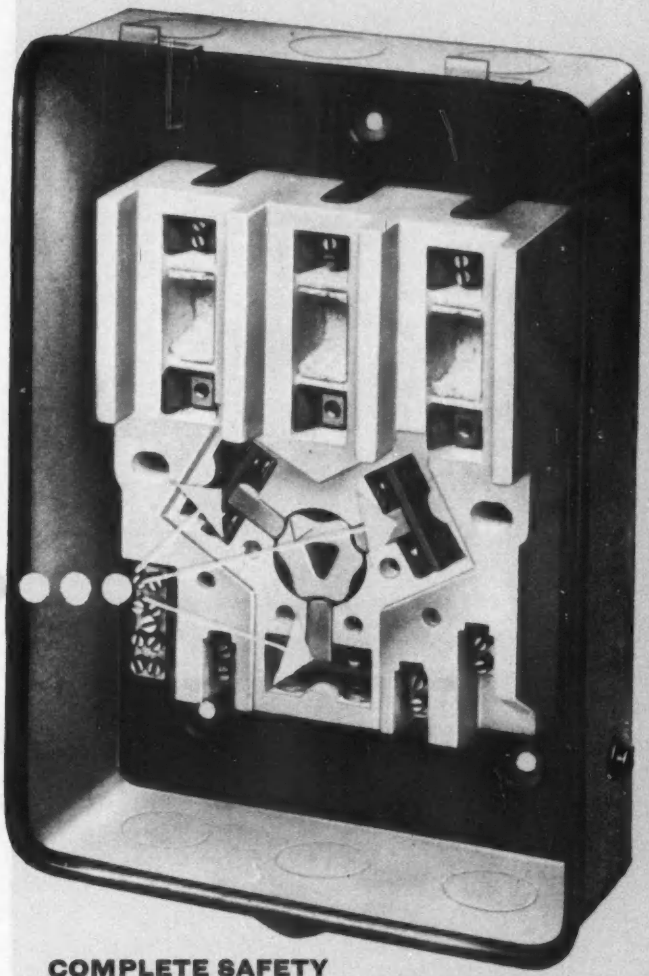
operations at
1½ times full load
on tungsten
lighting load
and still
fit for duty



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15-30 or 60 amp. 440 volts a.c. with rewireable or H.R.C. fuses.

'Hidutac' by G.E.C.—switchgear of advanced design combining high performance, complete safety and good looks. High breaking capacity makes 'Hidutac' switchgear ideally suitable for motor control, transformer and discharge lighting control.

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H.R.C. fuses (all ratings) AC 4 of BS 88 (33000 amps.)

Rewireable fuses 15 & 30 amp. ratings. S2A of BS 3036 (2000 amps.) Rewireable fuses 60 amp. rating. S4A of BS 3036 (4000 amps.)

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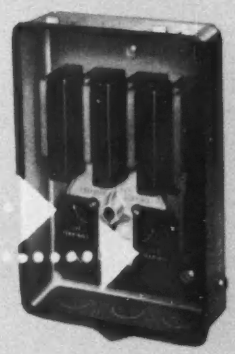
For complete safety all INTERNAL moving parts are totally enclosed. Switch element for each phase is an individual enclosure to give maximum protection against flashover. Incoming terminals are screened by shields bearing the words "Live Terminals". Full interlock is provided between cover and switch mechanism.



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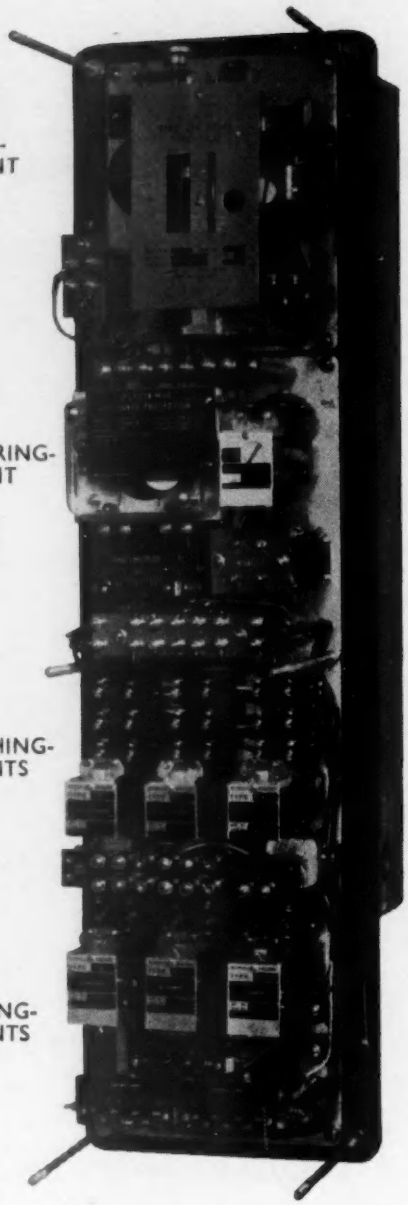

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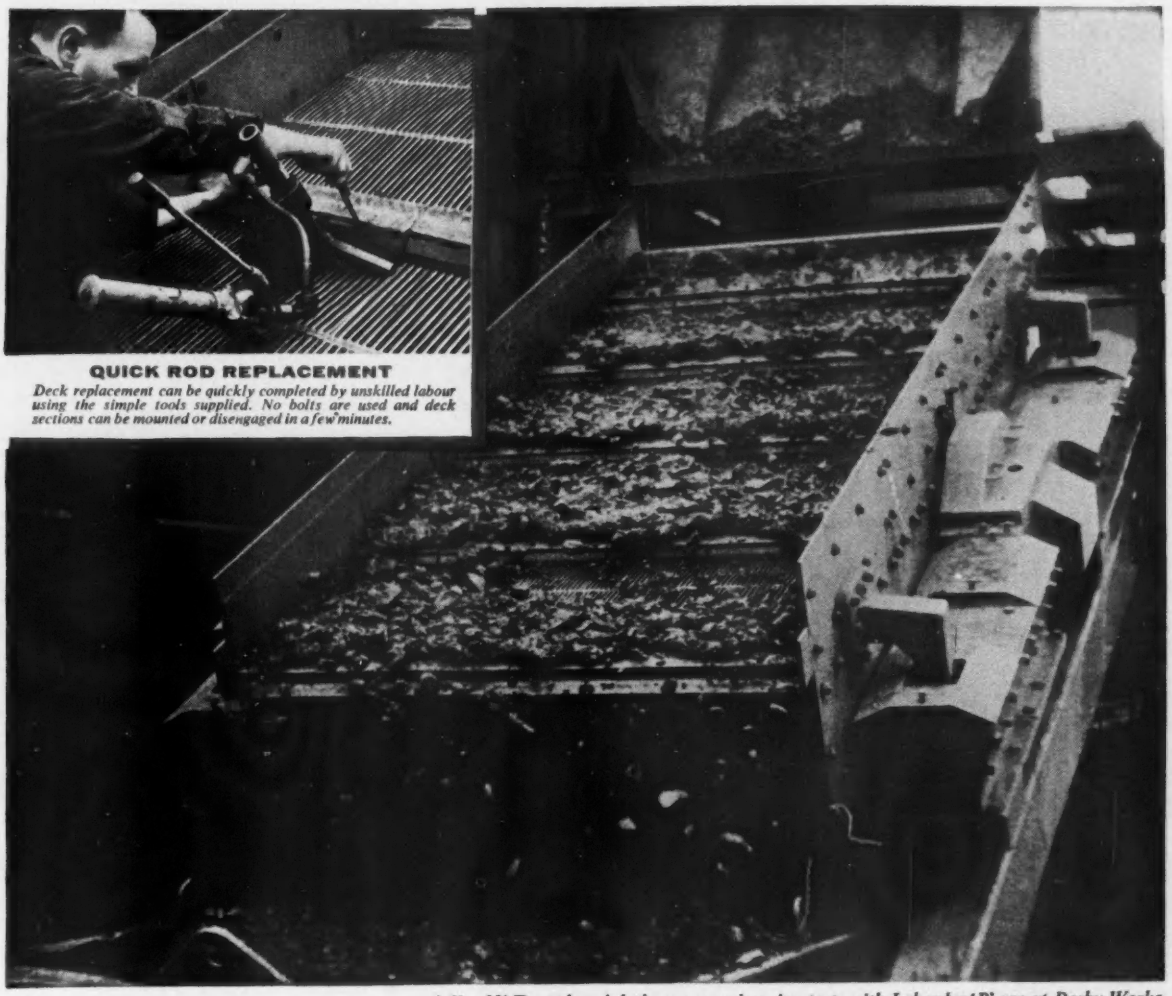

A 6′ x 12′ Ty-rock rod deck screen undergoing tests with Labrador 'B' ore at Derby Works.

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with TY-ROCK Rod Deck Screen

This screen, part of the range of equipment made by International Combustion for ore handling, has proved its efficiency. Outstanding results are being obtained with ores known to be difficult to handle. The unique construction of the TY-LOC rod deck sections cuts maintenance, reduces operating costs.

TY-ROCK *is a registered trade name*

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medium voltage

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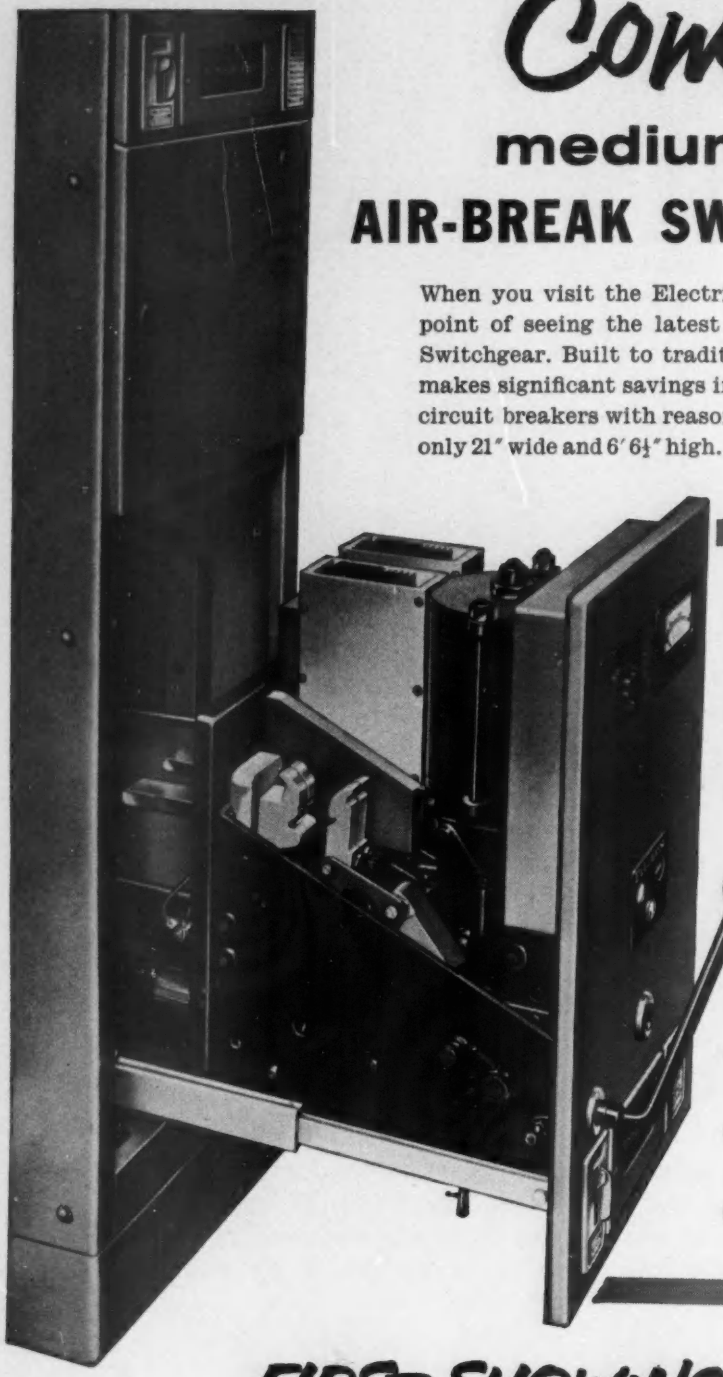

IN WHAT OTHER AIR-BREAK SWITCHGEAR CAN YOU FIND ALL THESE FEATURES?

- *Unusually compact dimensions (800 amp.—18¼″ wide.*
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ELECTRICAL ENGINEERS EXHIBITION

GEORGE ELLISON LIMITED

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881

THURSDAY 9 MARCH, 1961
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ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

Dans ce numéro

Rendement des lampes fluorescentes 359

Le rendement lumineux des lampes fluorescentes augmente en fonction de la longueur du tube et en fonction inverse de la pression du gaz dont le tube est rempli. Néanmoins, on accélère le déclin du débit lumineux et l'on amoindrit la durée du tube quand on réduit la pression du gaz. Dans une lampe fluorescente de conception nouvelle, la charge pour un tube de 244 cm est ramenée des 125 W habituels à 85 W, et la pression du gaz est ramenée de 3 à 2 mm. de mercure. Ces lampes s'emploient par paires, montées en série. Pour une quantité d'énergie donnée, elles ont un débit supérieur de 35% à celui d'une lampe de 125 W.

Réglage du chauffage utilisant les heures creuses ... 362

Les installations de chauffage par accumulation montées dans les locaux privés doivent être débranchées du secteur aux heures de pointe. Un examen des méthodes de contrôle possibles a montré que le système le plus économique consiste à utiliser des minuteries montées aux sous-stations, avec emploi, dans les câbles de distribution, d'une cinquième âme commandant des contacteurs locaux.

Applications des plastiques aux câbles électriques ... 367

Il ressort d'un rapport soumis à une conférence sur l'application des plastiques et du caoutchouc aux câbles électriques que, pour la transmission d'énergie à 275 kV, les câbles souterrains peuvent coûter 17 fois plus cher que les lignes aériennes mais que leur adoption peut être exigée par l'opinion publique. D'autres rapports décrivent les améliorations apportées à la diélectrique des câbles par l'irradiation, les applications de caoutchouc au butyle et l'emploi d'autres plastiques nouveaux. Il résulte de recherches effectuées récemment en Amérique que l'emploi de certains additifs permet d'améliorer la résistance des plastiques à l'oxydation.

In dieser Nummer

Der Leistungsgrad von Leuchtstofflampen 359

Die Leuchtgüte von Leuchtstofflampen nimmt mit der Röhrenlänge und der Herabsetzung des Gasdrucks in der Röhre zu. Andererseits liefern sie weniger Licht und haben kürzere Lebensdauer, wenn der Gasdruck sinkt. Bei einer neuen Leuchtstofflampe von 244 cm Röhrenlänge wurde der gebräuchliche Belastungswert von 125 W auf 85 W und der Gasdruck von 3 auf 2 mm herabgesetzt. Diese Lampen sind so konstruiert, dass sie paarweise in Reihe arbeiten. Im Vergleich zu dem 125 W-Typ liefern sie 35% mehr Licht.

Steuerung von Heizanlagen 362

Die mit Speicherung arbeitenden Haushaltsheizanlagen müssen während der Spitzenlastperioden vom Netz abgeschaltet werden. Bei einer Untersuchung der hier zweckmässigen Steuerverfahren ergab sich als die wirtschaftlich vorteilhafteste Methode die Anwendung von Zeitschaltern bei Unterwerken, unter Verwendung eines fünften Leiters in den Verteilerstammleitungen, der am Ort vorgesehene Schütze steuert.

Plastik und Gummi für Kabel 367

Eine Konferenz, die sich mit der Verwendung von Plastik und Gummi bei elektrischen Kabeln befasste, erfuhr, dass Untergrundkabel im Vergleich zu 275 kV übertragungsleitungen siebzehnmal teurer sein können, dass jedoch die öffentliche Meinung ihre Anwendung sehr wohl erforderlich machen kann. Weitere Vorträge beschrieben die in Kabeldielektrika durch Bestrahlung erzielten Qualitätsverbesserungen und die Anwendungen von Butylkautschuk und anderen neuen Plastikmaterialien. In letzter Zeit haben in Amerika durchgeführte Arbeiten eine Verbesserung in der Oxidationsfestigkeit von Plastik ergeben, die durch die Anwendung gewisser Zugaben erzielt werden kann.

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New British Standards
FOR P.V.C. INSULATED CABLES
as from 1st March 1961

B.S. 2004 : 1961
P.V.C. INSULATED CABLES AND FLEXIBLE CORDS

This is a revision of B.S. 2004:1953 incorporating reduced thicknesses of insulation and sheathing. CABLES TO THIS NEW STANDARD WILL BE ON SALE AS FROM 1ST MARCH.

B.S. 3346 : 1961
ARMOURED P.V.C. INSULATED CABLES

This is a new British Standard, but it has been available for some time in draft form. We have been supplying cables to the new standard under the description "Cable to Draft B.S." or "D.B.S." The new British Standard number will be used for describing these cables as from 1st March 1961.

Note: The publication of the above Standards has unexpectedly been delayed and they may not be available in printed form for several weeks. They will, however, be regarded as applicable from 1st March 1961.

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WHILE STOCKS LAST

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Associated Electrical Industries Limited
Cable Sales Department, 51-53 Hatton Garden, London ECI Phone Chancery 6822

ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 9 MARCH, 1961

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Comment

CABLE-LAYING RESEARCH

Research by the cable-making industry was under attack last week from Sir Christopher Hinton. The CEGB chairman, speaking to cable-makers on their own ground, told a conference on rubber and plastics cables that continuance of impregnated paper as the best cable material implied that research over the last 70 years had not been sufficiently imaginative. The premise here is that something better must exist and, in view of developments in industrial chemistry, that seems possible. On the other hand, at the conference, a cable industry spokesman classed the possibility of developing a suitable synthetic material for cables as still rather remote. Sir Christopher's own research organisation is giving plenty of attention to the problem of producing cheaper underground transmission, although without any marked success yet. Design staffs as well are tackling the question of ameliorating the interference of transmission equipment with people's enjoyment of landscape; but without any striking break-through of ideas. The prospect of avoiding overhead transmission lines from the coastal nuclear stations by using d.c. submarine transmission has disappeared under the realities of costing, and the one promising approach remaining is the practicable, but still expensive, stratagem of undergrounding the last half-mile or so of lines where they congregate together near switching stations. Such a technique will have some advantages in terms of surge protection for station switchgear and transformers, as well as in the avoidance of "wirescapes" on the Northfleet scale; but it will cost a lot. Extensive undergrounding remains as impossible as ever, for technical reasons as well as financial.

COMMERCIAL CONFERENCE

At the conclusion of the EDA sales conference on Friday, it was made clear that Harrogate is likely once more to see the commercial staffs of the electricity boards, and the now-established exhibition, back next year. So it seems that a regular form is becoming established, with the biennial wanderings between London and the provinces left behind, the exhibition established as a regular event, and Harrogate as the venue. There was another change this year which may be considered justified; inclusion of a paper from the manufacturing side of the industry with manufacturers also joining in the ensuing discussion to answer plenty of criticism from the supply industry delegates. The mild blood-letting that is usually present on these occasions results in some good in the way of subsequent better understanding of mutual difficulties, and it must be hoped that this sort of arrangement

Next week's "Electrical Times" will contain a stand-by-stand preview of the Electrical Engineers' Exhibition, which opens at Earls Court on 21 March

is not allowed to lapse. All in all, this year's conference had a desirable commercial air to it; there was not the extent of concern with technical matters which has sometimes seemed to loom too large in the sales conference, welcome as they may be to area board engineers and to some of the commercial staffs. Even the most technical of last week's papers, that on control of floor-warming, tackled its subject in a commercial manner, with a firm grasp of the customer considerations besides the technical elegance of the solutions being put forward at present. This same paper was valuable as well through providing the basis of a sharp discussion of the vexed question in development tactics, should control of floor-warming—and payment for it—be in the hands of the landlord or the individual tenants in blocks of flats? No clear answer seems available as to which is more desirable from the supply aspect, but it is important for every board to have its own policy on this point clearly worked out.

CEILING IN STEAM

Speakers in a discussion organised last week by the steam group of the Institution of Mechanical Engineers showed little of the enthusiasm for ever-higher temperatures and pressures sometimes met. Quite solidly, the speakers backed acceptance of the existing 2,300 lb/sq in., 1,050°F t.s.v. conditions as the ceiling for some time yet, apart from experimental designs. The grounds seemed to be that there remains plenty to learn about the behaviour of steam and of how to operate boilers and turbines at such high temperatures and pressures. Such knowledge needs to be consolidated before a general advance is attempted to supercritical operation, and the higher temperatures that should match it for maximum economy. American supply authorities had ventured quite extensively into the supercritical range; but they were seen now to be in retreat to the general level of temperatures and pressures accepted in this country. In fact, greater complexity of cycles, in terms of double reheating of the steam, seems more in favour across the Atlantic than the jump in pressure to above the 3,300 lb/sq in. mark. In all these matters, water purity is, of course, an outstandingly significant influence, and experience with unexpected troubles due to copper transfer from feed heating equipment, leading to turbine out-of-balance, is illustrative of the difficulties lurking in the path of steam engineers. Such difficulties can certainly be overcome, but they signal clearly the desirability of proceeding with some caution.

HIDDEN ON VIEW

This year's Ideal Home Exhibition brings further signs that designers of electrical domestic appliances are giving attention to the problems of the flat-dwellers with limited storage room. A vacuum cleaner styled to look like a coffee table, for lounge storage, is amongst the new products; it joins the now-familiar dining-room refrigerator as an extreme example of the trend. Less extreme have been the attempts to disguise as something else, equipment which is too heavy to move and which is likely to find its application in the living-room, as with TV sets and sound-reproduction equipment, which for some time has been available in designs that make it look more like inert furniture than can normally be expected of electrical equipment. Table-top cooking with electric skillets is an undisguised intrusion of kitchen into dining room. Where does this trend take us? Presumably, home laundry equipment must be reckoned next on the list for this type of treatment, although just how this is to be accomplished is not readily apparent. But then, ingenuity and intuition rather than design plodding is a requirement of this type of development.

GAS TURBINES FOR THE PEAK

Amongst many thought-provoking comments in the latest UN report on Europe's supply industry performance and prospects is a suggestion that there are signs of increased attention to the design of special peak-demand thermal plant. In this field the gas turbine is pre-eminent, and the report devotes a special study to the progress that has been achieved. It estimates that early last year there were some 2,000 gas turbine plants in service, apart from aviation, with a total capacity of about 3,000 MW. Not all of these were in use for electricity production; a table on a world-wide basis lists only 52 sets in this category. A sharp limitation on size is effective the world over, but of limited significance from peak supply considerations. A Russian design for a 100 MW machine is reported, but in general 25 MW is the limit, with very few larger machines. Within this size range, however, and where the easier fuels have been in use, experience seems to have been relatively satisfactory, with teething troubles readily overcome and long periods of satisfactory running achieved. No startling break-through has been achieved as yet with some of the complex and sophisticated cycles in which gas turbines are combined with steam station operation, but there again, modest success is reported from some stations. Of the recent ideas noted, the most intriguing remains that of using underground storage of compressed air to power a turbine during peak demand hours. The air is compressed, using electric motor drive outside peak hours.

Meteor

This week's quick summary of electrical news faces advertisement page 16

More lumens per watt

FACTORS AFFECTING FLUORESCENT TUBE EFFICIENCY

by G. V. McNeill, A.M.I.E.E., Dip.M.I.E.S.*

FLUORESCENT lighting is now generally accepted as being the most economic form available. Within the present day commercial range of tubes and control gear there are wide variations in efficiency and cost, largely because of a tendency to consider them as separate design items which are only loosely related. In addition, the design of the fitting is also a relevant factor since it governs tube operating temperature which, in turn, noticeably affects lumen output. If, however, we endeavour to design tube, control gear and fitting as a combined operation, directed towards the production of a unit which will give the required level of illumination for the normal industrial or commercial installation, we should be able to achieve an overall efficiency appreciably higher than currently available.

Such a design exercise has, in fact, been carried out in the Atlas Lighting Laboratories. Let us see how the various factors have been combined to produce the 8 ft, 85 W twin-circuit with its outstanding performance.

Tube Design Features

(a) End losses. A fluorescent tube operating with a given arc current has a fixed end loss which is due to voltage drop in the vicinity of the electrodes and, in the case of tubes operating at 0·85 A, the end losses are in the region of 14 W. It can be seen from Table 1 that end losses become relatively less important as tube length increases.

Table I

Tube size and watts	End Loss	Useful watts	Relative efficiency	Efficiency l/W
2 ft, 40 W	14 W	26 W	65%	46
5 ft, 80 W	14 W	66 W	83%	65
8 ft, 125 W	14 W	111 W	89%	69

This table shows that luminous efficiency increases directly with tube length. In practice, 8 ft is the longest tube length for convenient handling and is the size generally recommended for high efficiency lighting installations.

(b) Gas pressure. Fluorescent tubes are argon-filled and normally a gas pressure of just below 3 mm is used. If this pressure is reduced, then the following effects will result: (1) the initial light output will be increased, (2) the lumen maintenance will decrease, and (3) the life of the tube will be shortened.

Fig. 1 shows the effect of reducing the gas pressure by 1 mm in the case of 8 ft tubes loaded to 125 W and 85 W. Compared with standard tubes at 3 mm pressure, the tubes at 2 mm pressure have approximately a 6% increased initial light output, but in the case of the higher loaded tube (125 W) the increase in average light output is negligible. It can also be seen that the decrease in light output between initial and 5,000 hr (lumen maintenance) is quite considerable for the 125 W, 2 mm pressurised tube, in fact, it is too great a decrease to suit modern lighting practice. The tube loaded to 85 W has better lumen maintenance and, even at 2 mm, it is equal to that for existing 8 ft, 125 W tubes.

(c) Tube life. The foregoing factors mean that an 8 ft tube with 2 mm gas pressure loaded to 85 W will achieve an acceptable lumen maintenance with an initial efficiency of more than 80 l/W and, even more important, an average of 74 l/W throughout 5,000 hr of life. The effect of reducing the gas pressure to 2 mm will be to halve the normal 3 mm life, and this is not acceptable with present-day tubes. A revolutionary design of filament has been developed in the Atlas Lighting Laboratories, which now overcomes the life deficiency.

* Technical Sales Engineer. Atlas Lighting Ltd.

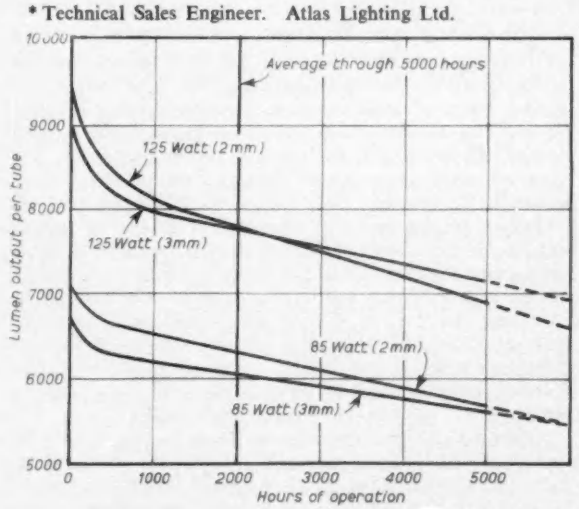

Fig. 1. Comparison of lumen maintenance between tubes exhausted to 2 mm gas pressure and to 3 mm gas pressure

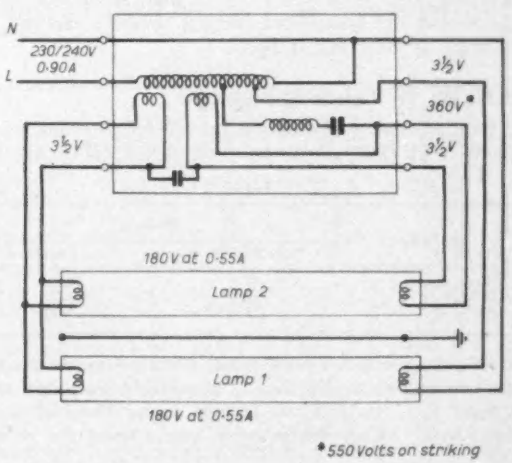

Fig. 2. Circuit diagram of the "Twin-start" circuit for operating two 8 ft, 85 W tubes in series on 230/240 V mains

The 8 ft, 85 W Tube

All of the above features have been incorporated into a new high efficiency tube, which has been developed with the same physical dimensions as existing 8 ft, 125 W bi-pin tubes but rated down to 85 W. This tube and its control gear have a number of advantages over existing tubes and circuits which lead to a considerable saving in lighting costs, as we shall show later. All of the data is based on the "White" tube colour, but the new 8ft, 85 W tube is also to be made available in "de luxe natural" for display lighting.

Circuit Design

With a 2 mm gas pressure, starting is easier and operating arc volts are lowered. The new design of cathode filament operates with a fixed 3·5 V of cathode heating, as against the normal 10 V pre-heating and 5 V running with existing quick-start circuits. These factors have been taken into consideration in the design of a new control circuit which gives quick-start type operation of two 8 ft, 85 W tubes connected in series. This "twin-start" circuit is enclosed within a single ballast unit for 230/240 V, 50 c/s supplies.

A starting voltage (550 approx.) is applied across lamp 1 through a small starting capacitor, so initiating a glow discharge. The voltage impressed across the starting capacitor and lamp 2 in parallel establishes a glow discharge through the second tube. Both discharges are maintained in series until the cathode filaments reach emission temperature, when the discharge changes from glow to arc state. Both tubes then continue to operate, the series capacitor providing the necessary power factor correction for the inductance in the ballast.

The complete circuit operates at unity power factor† and with a mains current of approximately 0·9 A. The control gear losses for the twin-tube circuit is 35 W, making a total of 205 W, or 216 VA. This compares with a loading of about 200 W at 0·87 power factor for a twin-tube 5 ft, 80 W quick-start circuit. The VA loading is, therefore, reduced from 230 to 216 by using the twin-tube 8 ft, 85 W fitting in place of a twin-tube 5 ft, 80 W unit, yet the 85 W fitting gives close on 50% more light.

For reliable starting, earthed metalwork adjacent to the tubes is essential and, on 230/240 V supplies, satisfactory striking will be obtained in ambient temperatures down to 5°C. It is not possible to operate the two tubes separately with this type of control circuit. Although it is not recommended, 8 ft, 85 W tubes can be used in existing 125 W quick-start or switch-start fittings without causing any damage to the tubes or gear.

8 ft, 85 W Tubes in Fittings

Because of its lower loading (10·5 W/ft as compared with 16 W/ft for 5 ft, 80 W and 8 ft, 125 W tubes) the 8 ft, 85 W tube operates with a cooler surface temperature and gives its maximum light output in ambient temperatures of around 15°C to 20°C. It is also found that, when the temperature of air immediately surrounding the tube is more than 20°C, as in reflector or diffuser type fittings in normal locations, the reduction in light output is less than for higher-loaded tubes. Table 2 makes a comparison of the light output, expressed as a percentage of that of the bare tube in open air, with that of 8 ft, 85 W tubes in fittings of equivalent design.

Table 2

Type of fitting	Efficiency	
	Twin 8 ft, 85 W	Twin 5 ft, 80 W
Batten	87%	83%
Diffuser	68%	62%
Reflector	77%	71%

† Actually the power factor, as measured, is 0·95 but this is due to the form factor inherent in all arc-discharge lamps and cannot be corrected.

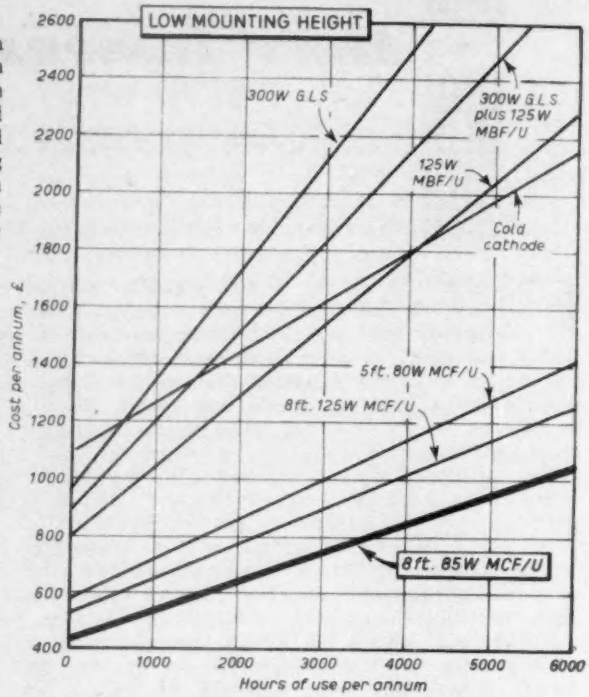

Fig. 3. Comparison of low mounting economics between different illuminating sources

It can be seen that the twin-tube 8 ft, 85 W combination gives 6% more light than the 5 ft, 80 W tubes in comparable reflector or diffuser type units. Added to the already high efficiency of the tube itself, operating in free air, it is found that a twin-tube 8 ft, 85 W enclosed diffuser fitting gives 50% more light output than a twin-tube 5 ft, 80 W fitting (8,600 lumens, as against 5,750 lumens).

Light Output per Fitting

In designing a new twin-tube circuit, consideration has to be given to the optimum choice of light output per fitting which is most suited to modern lighting requirements. For example, a fitting which gives 50,000 lumens would only be suitable for use at mounting heights of 20 ft or more, allowing for normal lighting levels on the working plane. In the majority of buildings this is not possible.

Recommended levels of illumination in the immediate future will be around 30 to 40 lm/sq ft for general office or factory lighting, while the mounting height of fittings above desk or bench top will be between 7 ft and 10 ft. Allowing for 7 ft to 8 ft in offices and using enclosed diffuser fittings or 9 ft to 10 ft for reflector fittings in industrial areas, it will be found that the output of 12,600 lumens per twin-tube 8 ft, 85 W fitting is ideal in providing an economic layout with uniform illumination.

It should also be noted that the lower loading of 10·5 W per ft of tube reduces the surface brightness of the 85 W tube to 5·4 candelas/sq in., as compared with 6·5 candelas/sq in. for 5 ft, 80 W tubes. This reduction of 17% in tube surface brightness helps to reduce the degree of glare in any given installation.

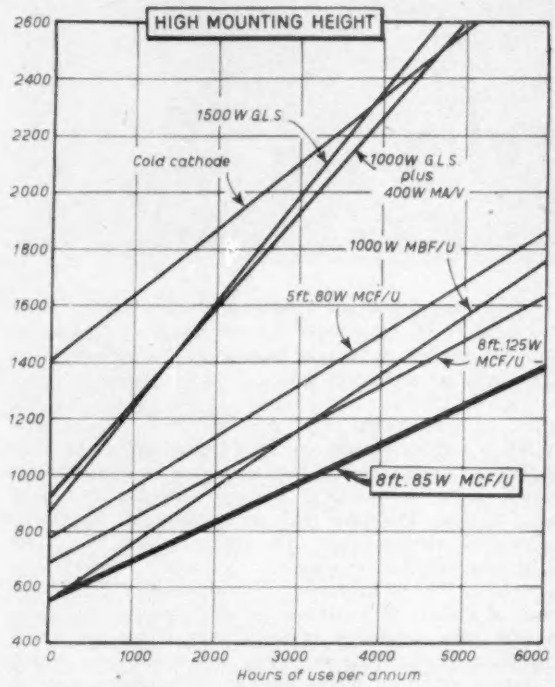

Fig. 4. Comparison of high mounting economics between different illuminating sources

Summary of Performance

By combining all of the previously mentioned factors affecting tube, control gear and fitting performance, it can be shown that the following advantages are to be derived from the use of the twin-tube 8 ft, 85 W fitting in place of the most popular fluorescent tube size in general use at the present time, the 5 ft, 80 W fitting. First, there is a 25% higher tube efficiency; secondly, there is 35% more light output for the same electrical load; thirdly, there is a 10% better efficiency from reflector and diffuser fittings and, finally, there is a 17% reduced surface brightness with corresponding smaller glare risk.

These advantages, which are all incorporated in the Atlas "Super Eight" tube and circuit just released, have an important influence on the subsequent economics of lighting in industrial or commercial installations. Let us make a comparison with other lighting sources in present-day use.

Comparison of Lighting Economics

Costs have been worked out for similar 200 ft by 100 ft working areas using seven different light sources with lamps mounted at 30/35 ft and 10/12 ft above the working plane. In each case the lighting scheme is designed to provide the same average illumination (30 lm/sq ft) and employs the size of lamp most suited to the particular mounting height. From the results, Figs. 3 and 4 have been prepared which clearly show the economic superiority of the new tube and circuit. The graphs are supplemented, in Table 3, by the detailed figures for tubular fluorescent sources, the final line being a comparison of total annual lighting cost on a 4,000 hr basis using the "twin-circuit" and 85 W tube as the datum.

Fixed Costs

The capital costs for the fittings are based on high-grade industrial reflector fittings with power factor corrected ballasts and, in the case of fluorescent tubes, quick-start or equivalent control gear. A proportion of the list price has been deducted to allow for discounts applicable to a medium user and annual amortisation/depreciation is taken as 15%. Installation cost is based on a 50 ft run of main feeder to a distribution box with local circuits in trunking and final runs in screwed conduit. Amortisation is taken as 10%. Cleaning costs are based on a six-monthly rota with lamp replacements included in the running costs.

Running Costs

Electricity charges are based on an average of £10/kVA (incorporated in fixed costs) and 1d per kWh. Since charges vary from district to district, the table can be modified with little difficulty to suit, but it will be found to make little difference to the ultimate comparisons. Lamp replacement figures include medium sized user discounts and, where applicable, purchase tax. Labour charges for lamp replacement are based on group replacement practices which coincide with cleaning. If lamps are replaced individually the figures shown will have to be increased. Perhaps the most significant comparison is between the new tube and circuit and 1,000 W mercury fluorescent, at present considered the most economic for high bay lighting. The new circuit and tube can show saving of 20% on the mercury fluorescent costs, which not only justifies the claim that fluorescent lighting is ideal for high bay illumination but that it can also be the most economic.

Table 3

Type of Lamp	High Mounting				Low Mounting			
	Cold Cathode	Tubular Fluorescent	Tubular Fluorescent	Tubular Fluorescent	Cold Cathode	Tubular Fluorescent	Tubular Fluorescent	Tubular Fluorescent
No. and Size of Lamps per Fitting ...	3×70 W 8ft 6in	2×5ft 80 W MCF/U	2×8ft 85 W MCF/U	2×8ft 125 W MCF/U	3×70 W 8ft 6in	2×5ft 80 W MCF/U	2×8ft 85 W MCF/U	2×8ft 125 W MCF/U
Coefficient of Utilisation	0·51	0·49	·53	0·51	0·645	0·62	·67	·645
Total Number of Fittings	177	165	112	95	140	130	89	75
Total kW Load	39·8	33·0	22·95	30·4	31·5	26·0	18·25	24·0
Total kVA Load	45·8	37·9	24·15	34·95	36·2	29·9	19·2	27·6
Fixed Costs per Annum								
15% of Fittings Cost	£723 0 0	£217 2 0	£179 0 0	£199 10 0	£572 0 0	£171 2 0	£142 4 0	£157 10 0
10% of Installation Cost	£140 0 0	£120 0 0	£100 0 0	£95 0 0	£100 0 0	£80 0 0	£70 0 0	£65 0 0
Total Cleaning Cost	£88 10 0	£61 18 0	£56 0 0	£47 10 0	£49 0 0	£32 10 0	£31 3 0	£26 4 0
M.D. Charge at £10 kVA per annum	£458 0 0	£379 0 0	£241 15 0	£349 10 0	£362 0 0	£299 0 0	£192 0 0	£276 0 0
Total Fixed Annual Costs	£1,409 10 0	£778 0 0	£576 15 0	£691 10 0	£1,083 0 0	£582 12 0	£435 7 0	£524 14 0
Running Cost per 1,000 Hours								
Lamp Costs	£56 2 0	£34 13 0	£29 13 0	£25 7 0	£44 6 0	£27 7 0	£23 10 0	£19 16 0
Lamp Replacing Cost	£7 2 0	£8 5 0	£6 14 0	£5 14 0	£3 10 0	£3 18 0	£3 12 0	£3 0 0
Electricity at 1d kW/hr	£166 0 0	£137 14 0	£95 12 0	£126 16 0	£131 2 0	£108 8 0	£76 4 0	£100 0 0
Total Running Cost per 1,000 hrs ...	£229 4 0	£180 12 0	£131 19 0	£157 17 0	£178 18 0	£139 13 0	£103 6 0	£122 16 0
Total Annual Lighting Cost								
Per 1,000 hours per annum ...	£1,638 14 0	£958 12 0	£703 14 0	£849 7 0	£1,261 18 0	£722 5 0	£538 13 0	£647 10 0
Per 4,000 hours per annum ...	£2,326 6 0	£1,500 8 0	£1,104 11 0	£1,322 18 0	£1,798 12 0	£1,141 4 0	£848 11 0	£1,015 18 0
% of 8 ft 85 W Cost (4,000 hrs) ...	211%	136%	100%	120%	212%	135%	100%	120%

Selling in supply

PAPERS AND DISCUSSIONS AT E.D.A. CONFERENCE

DURING the final stages of the EDA Sales Conference it was announced that Harrogate is again to be the venue next year, the provisional date being 20 to 23 February. That suggestion is in itself a reflection of the lively discussions that marked a week's activity by delegates from the commercial side of the supply industry, and of the success of the exhibition.

Three of the papers presented to the conference were summarised in our columns last week. This week the discussion they gave rise to is reported; but first the final two conference papers must be summarised.

Controlling Floor-warming

Off-peak floor-warming in blocks of flats and other domestic premises has to be time-switched to interrupt supply during potential peak periods. Comparison of methods of control available to electricity boards formed the main subject of the paper by Mr A. F. Hardcastle (Southern Electricity Board).

Mr Hardcastle listed as the methods available for control of off-peak supplies:

1. Individual time switches (with or without contactor).
2. Time switch and contactor in multi-storey buildings.
3. Centralised remote systems of control.
   (a) DC bias system;
   (b) Rythmatic system;
   (c) Pilot wire in distribution mains, i.e., fifth or sixth core.

Of the various ways of using a time switch and contactor in multi-storey buildings, he preferred use of a common rising main for both unrestricted and off-peak supplies, with separate lateral services. In this arrangement, the off-peak supply would be controlled by time switches operating contactors at the suitable points, with metering provided at each flat. This scheme required three-wire services to be provided for each flat, or a four-wire service if space-heating were the landlord's responsibility, and water-heating that of the tenant.

Table I. Comparative Costs of Control Systems for 45-house scheme

	Capital Cost	Annual Costs
	£	£
Pilot core scheme	462	74
Master time switches	619	111
D.C. bias	955	136
Individual time switch	972	163
Rythmatic	1,104	154

As used in one 15-storey block of flats, three-core lateral services with 0·0225 sq in. conductors were installed. One core was used for unrestricted supplies, one for off-peak supplies and the third core as a common neutral. In this case, contactors were operated by a system of pilot wires, running from a master time switch installed at the intake point. All meters (both landlord's and tenant's), contactors and switchgear were installed in the distribution room on each floor.

The three methods of centralised remote control were discussed by Mr Hardcastle at some length. In connection with the d.c. bias system, he emphasised the difficulty that arose with direct-current drawn from the mains by transformerless television sets. However, this system had the merit of low capital cost, and the SEB had recently installed such a system on an experimental basis. The Rythmatic system, he felt, had a number of disadvantages which might be serious if it were used for control of space-heating. The three pilot wire system Mr Hardcastle considered without doubt "the cheapest form of control in general distribution networks, where ten or more consumers were likely to take an off-peak supply." The system was, of course, an extension of the principle of having a fifth core conductor in distributing mains for street-lighting control. Where there was such a fifth core already in use, a sixth core would have to be considered for off-peak purposes. Table 1, reproduced from the paper, shows comparative costs of this and other methods.

With such an arrangement, a voltage-operated contactor would be the only off-peak load control equipment in the consumer's premises. Substations would have two time switches and an auto-transformer for impressing control signals. An important advantage of such a project was reduction in number of time switches needing inspection and overhaul. Such attention was needed twice a year for any type of time switch in any of the schemes under consideration. Pilot core size was reckoned at 0·0225 sq in., with 0·007 sq in. in services.

In the final section of his paper, Mr Hardcastle discussed whether landlord or tenant should have control of off-peak heating supplies, and who should pay for the energy. It was important that at an early stage in negotiation with landlord's (commonly local authorities in the case of flats) agreement should be reached on whether the installation was to be in tenant's or landlord's control.

There were two different schools of thought as to the method of control. In favour of tenants' operation, it was argued that each tenant could adjust his thermostat according to his needs and pay for what he wanted. Also, he could switch off the floor-warming installation when away from home. On the other hand, with landlord's operation, all tenants received the correct amount of heat for which the installation was designed. There was no temptation, for example, for some tenants to switch off their floor-warming and draw heat from adjacent flats. Equally, condensation problems disappeared.

Small Industrial Consumer

Area boards had not given the small industrial consumer as much attention as domestic, commercial and rural consumers, argued Mr A. Ellison (North Eastern EB) in a paper on their needs. However, such consumers expected help from area boards, and boards could do much for them. In the context of his paper, small industrial consumers were reckoned as those having a maximum demand of less than 100 kW. In the NEEB area, for

Authors delivering their papers to the EDA conference. Left to right: Messrs C. Nield, S. F. Steward, A. F. Hardcastle, A. Ellison and W. F. Jarvis. Discussion had to be curtailed at each session because time had run out

example, there were 6,035 consumers coming within this category, out of a total of 8,300 industrial consumers. Most were supplied from l.v. networks.

Mr Ellison argued that small industrial consumers expected good commercial service from the board, and that this involved an advisory service of new supplies and additional load. In operating such a service, care needed to be taken to keep information in simple language, without becoming too technical. The small industrial consumer was usually a busy man, specialising in his own business. He was likely to welcome advice and assistance with the maintenance of his equipment.

A prominent difficulty in dealing with consumers in this class was that arising from demands for a contribution to cost of supply, especially where maximum demand was being increased. Mr Ellison suggested that consumers might prefer slightly increased standard tariffs, rather than contributions being demanded for permanent additional loads and new supplies. He asked whether it was time that the boards "thought less of exercising their rights under the Electric Lighting (Clauses) Act of 1899, and more of Mr 1970."

Another point which Mr Ellison advanced, was that boards might be getting out of date in tariff structure. The time might be opportune, he suggested, to bring tariffs more into line with costs, and to consider abolishing variable block tariffs. Such a step would eliminate the need for assessment of consumers, and so save time of commercial staff and simplify account billing.

Suitable staff for industrial development were in very short supply, and boards were likely to have to train their own industrial engineers. Cross-posting of young engineers between engineering and commercial departments might be advantageous in this respect, and it was likely to be necessary to achieve parity in the grades offered to engineers in commercial departments with those in engineering departments.

The latter part of the paper was devoted to considering what scope there was for development. This extended over the full range of industrial applications with particular reference to lighting and to electro-heat. In some boards, the NWEB amongst them, industrial development was carried out at district level, although more normally it was a matter for headquarters or sub-area. Commercial engineers had the advantage that the "image" of the board was, generally speaking, sufficiently good for them to be seen by manager or works engineer of concerns in their area without an appointment. In small factories, there was nearly always some electrical matter exercising the minds of these officials, which gave the board's representative an opportunity to be helpful.

Consumer service generally ought to involve social considerations. This, Mr Ellison argued, might be assumed to include advisory services on productivity, special terms for supply to small industrial consumers of new trading estates in unemployment areas and, perhaps, more generous terms and tariffs for off-peak space-heating loads, where requirements under Clean Air Act were pressed.

Display is a Matter of Opinion

Open-back display windows versus the enclosed variety provided the main controversy in the discussion on Mr C. Nield's talk on the presentation of merchandise in service centres. Strongest opponent of the open-back window was Mr M. W. Hime, of Seeboard, who described it as an "abomination," saying that they do not give the display man the scope he needs. The "West End" view came from Mr C. A. Phillips, of LEB, who favoured display by inference, as with a bowl of flowers alongside a refrigerator, instead of a notice saying that it was a refrigerator and it kept things fresh. From that, opinion shaded right through to the idea of Mr Nield and others that the open-back window increased the display man's scope, quite apart from creating a "walk-around" atmosphere.

Surprisingly, there was no such discussion on demonstration rooms, which Mr Nield said were difficult to justify. Mr F. T. Gardner, of East Midlands, asked how large a board had to be before it could afford the services of professional display people. The South Western EB had the whole of their display work done by outside firms and the cost was about £3 a week per service centre; Seeboard spent about 6d/year/consumer.

Mr L. W. G. Hetherington, district commercial engineer of London's South Western District, thought the main attention should be on appliances which made the greatest contribution to load, such as cookers and water heaters. But Mr W. G. Nottage, also of LEB, argued for bringing customers into the showrooms to buy small items, possibly leading to large purchases.

Mr Irving addressing the conference. To the left are Messrs N. Philips and J. A. Stedman; on the right, J. I. Bernard and P. Honey

At the conference luncheon in the Crown Hotel. Left to right: Mr J. I. Bernard, Sir Robertson King, who presided, and Mr D. Irving

Watch Quality Plea to Manufacturers

This year's conference was the first at which the manufacturers had a voice, and the discussion following Mr S. F. Steward's paper on the future for appliances soon showed up divergent attitudes on some matters between the two sides of the industry. Board delegates taxed manufacturers with bringing out glamorous new products, often of dubious quality, and then failing to make available adequate spare parts or service instructions. "We have to live with the consumer and the apparatus for years," said Mr E. H. Skinner, of Seeboard. Closer inspection and quality control, perhaps along the lines of the car industry's methods, and better service manuals were urged by several speakers.

For the manufacturers, Mr E. G. Plucknett, of Simplex, said that had this been an audience of manufacturers and the same point raised, there would have been an equally loud round of applause, but did the delegates want a break-through in design? The trouble came after field testing ended and mass production began. Mr W. J. Bird, GEC, added: "Heaven preserve us from the problems of the motor industry." Board men continued to insist that they wanted both new designs and more reliable products.

All were agreed that there should be greater co-operation on publicity, though some speakers took the view that it seemed to be left to the supply industry to increase the size of the cake, while the manufacturers only seemed to be interested in increasing their individual shares.

Manufacturers kept off the subject of retail price maintenance, but it was generally agreed among the board delegates that some such scheme was necessary if there were to be satisfactory after-sales service. On the question of safety, majority opinion, among manufacturers at least, was that it was better for the new Approvals Board not to try to assess value for money and suitability for purpose.

Organise for Adequate Wiring

Why not form an adequate wiring council along the lines of the British Lighting Council? This suggestion came late in the discussion following Mr W. F. Jarvis's paper on more adequate wiring, so there was little opportunity for reaction from delegates, but Mr Jarvis agreed with the idea.

Summing up from the chair at this session, Mr D. Bellamy did not mention the matter, and said that the wiring situation was one of gradual evolution. Opening the session, Mr Bellamy had said "Let's get rid of those flexes."

Several speakers disagreed with the assumption of future load higher than 3 kW for any household appliance, but Mr Jarvis, never dogmatic, pointed out that in Germany loads for water heaters were already well above that. More than one speaker criticised Mr Jarvis for being too forward-looking. Surely present wiring had to be based on present requirements, they argued, otherwise who was going to pay? The suggestion of hire purchase terms for wiring received widespread support, and free installation when a customer bought an appliance was also advocated.

Mr P. Honey, of EDA, told delegates that a recommendation from the Ministry of Housing to local authorities to put more socket outlets in their houses was possibly just round the corner.

Landlord v. Tenant Control

The discussion following Mr A. F. Hardcastle's paper on the control of off-peak floor-warming concentrated on the administrative question of whether control of the installation should be in the hands of the landlord or the tenant. Technical aspects were barely touched upon, but the landlord/tenant problem proved vexed enough for a long and earnest discussion, with opinion apparently equally divided. At the end, the chairman of the session, Mr D. H. Kendon, said there had been no concrete result, but delegates had plenty to talk over and think about. There was a general feeling that a more concerted approach to local authorities and builders would yield a greater acceptance of floor-warming, and that, as a prerequisite, the electrical industry should find out more about the pros and cons itself.

Mr Hardcastle and the Southern Board were in favour of landlord control, largely on the grounds that in this way the installation was used as it is meant to be used, whereas they found that a third of the tenants did not use floor-warming at all under tenant control. But Mr J. W. Moule said that the South of Scotland Board, which has 20,000 flats with floor-warming, either built or under construction, all under tenant control, had taken a close observation and found that with few exceptions the tenants use the installation in the manner intended.

Industrial Representatives

Area boards were unlikely to attract people with the knowledge necessary to help the small industrial consumer only from outside the supply industry. The machinery to train them did not exist at the moment. These were points to emerge from the discussion on Mr Ellison's paper. Perhaps the Electricity Council were the people to organise the course, one speaker suggested. Others spoke of arranging for the student engineer to work for a time outside the supply industry, as had been done in a few cases.

There was quite a body of opinion in favour of simpler industrial tariffs. South of Scotland allowed an industrialist to run on one tariff for a year and, if that proved to be the wrong one, they made a retrospective adjustment to the more advantageous rate.

Sir Robertson King, chairman of the Electricity Council, returned to this theme when he rounded off the conference. The supply industry should not forget, he said, that 50% of their business was concerned with the industrial consumer. He wondered whether there was sufficient contact between the boards and industrialists who generate electricity themselves or use some other form of power.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Conductor Stringing Calculations

I REFER to an interesting article by Mr E. M. Clackson in the ELECTRICAL TIMES, 22 December, 1960, on "Conductor Stringing Calculations," and in particular to formulae: $t=(T_1-T_2)/C_2$ and $T_2=(T_1W_2)/W_1$ for the temperature change from the initial condition, and the tension, of the temperature dividing line of an equivalent-span type sag-tension chart.

In order to establish them, the author makes a passing statement that "at the dividing line temperature, the sag is equal to that obtained at the initial condition." This is a perfectly true statement, but, in my opinion, not an obvious one. On the contrary, it is part of a rather obscure general property providing that for any initial condition of a constant tension (T_1) with span at the temperature (φ_1) with the conductor load (W_1), there always exists a temperature (φ_2) corresponding to another conductor load (W_2) at which tension (T_2) is also constant with span. Any set of T_1, φ_1 and W_1, or T_2, φ_2 and W_2 can be equally selected as an "initial" condition, with result in the same sag charts, and associated with these sets, sags S_1 and S_2 are the same for any particular span length.

These equations (and the whole property) can be deduced directly from the basic cubic equation used for tension calculations. The deduction is based on either of the following observations made on a sag-tension chart:

(1) The tension of the temperature dividing line is equal to the limiting tension ($T\infty$) to which all temperature curves converge if the span length (L) increases to infinity, $L = \infty$.

(2) The slope of the temperature dividing line is zero, thus $dT/dL = 0$.

From (1), using the author's nomenclature the initial cubic equation he gives is:

$$(C_1W_2L/T_2)^2 - T_2 = (C_1W_1L/T_1)^2 - T_1 + C_2t.$$

Dividing both sides by L^2 it becomes:

$$(C_1W_2/T_2)^2 - T_2/L^2 = (C_1W_1/T_1)^2 - T_1/L^2 + C_2t/L^2.$$

For $L = \infty$ the components divided by L^2 become zero and the equation reduces to:

$$W_2/T_2 = W_1/T_1, \text{ or } T_2 = (T_1W_2)/W_1.$$

The latter represents also $T\ \infty$.

From (2), if the cubic equation is written in the form:

$$(C_1W_2L/T_2)^2 - T_2 - (C_1W_1L/T_1)^2 + T_1 - C_2t = 0$$

which is $F(L, T_2, W_2, T) = 0$;

and observing that

$$dT_2/dL = -(\partial F/\partial L)/(\partial F/\partial T_2) \text{ it follows:}$$

$$\frac{dT_2}{dL} = -\frac{2(C_1W_2/T_2)^2L - 2(C_1W_1/T_1)^2L}{-2(C_1W_1L)^2/T_2^3 - 1} = 0$$

Since the denominator is not equal to zero this equation reduces again to:

$$W_2/T_2 = W_1/T_1, \text{ or } T_2 = (T_1W_2)/W_1.$$

Having established this relationship the other formulae follow as in the article, i.e., for the condition, of $W_2/T_2 = W_1/T_1$ the original cubic equation reduces to

$$T_2 = T_1 - C_2t$$

for all span lengths, and thus $t = (T_1 - T_2)/C_2$. Also:

sag $S_2 = (W_2/T_2) \times (L^2/8)$, equal to

sag $S_1 = (W_1/T_1) \times (L^2/8)$.

The formula $T_2=T_1-C_2t$ has yet another important significance. The condition at which it is valid, i.e., the two other quantities in brackets of a cubic equation being equal, is also satisfied for the zero span length $L = 0$. Designating the corresponding limiting tension by T_0 it follows that $T_0 = T_1 - C_2t$ for any given temperature variation, t.

It must be observed that the two limiting tensions, T_0 for $L = 0$, and $T\ \infty$ for $L = \infty$, have no real physical significance. They merely represent mathematical limits of tension curves on a sag-tension chart. They also offer another means of its interpretation. Using $T_0 = T_1 - C_2t$ and $T\ \infty = T_1\ W_2/W_1$ the basic cubic equation can be expressed in terms of these quantities in the following perfectly symmetrical form:

$$(C_1W_2).L = \sqrt{\frac{(T_2 - T_0)}{(1/T_2^2) - (1/T^2\infty)}}$$

or

$$\sqrt{\frac{(T_0 - T_2)}{(1/T^2\infty) - (1/T_2^2)}}$$

This means that the whole range of tension T_2 of any curve is always within its limiting values, i.e., $T_0<T_2<T\infty$, or $T_0>T_2>T\infty$, and it is completely defined by them. The T_2 is then a direct function of the span length (L), numerical scale of which depends on the conductor parameters and loading (C_1W_2).

In conclusion, the principle of the temperature dividing line, apart from the use indicated in the article, forms a convenient tool for analysing other sagging bases and, incidentally, for comparing the existing Overhead Line Regulations EL.C.53 with the proposed new Regulations now under consideration.

A. A. Rayski,
TEDDINGTON,
MIDDX.

Consumer Unit Rating

I WAS most interested in the article "Care in Domestic Wiring" which appeared in your issue of 16 February, and particularly in the author's comments regarding the growing need for a consumer control unit having a higher incoming rating than 60 A.

The latest addition to the range of Loadmaster domestic units manufactured by Dorman and Smith Ltd. has been designed to fulfil this need. The unit contains a 100 A incoming isolator and is easily capable of catering for the larger cookers which are now becoming popular.

T. G. F. Atherton, M.A., A.M.I.E.E.,
DIRECTOR, DORMAN AND SMITH LTD.

Installing and Jointing Solidal Cables

IN further reference to the exchange of correspondence in your issue of 16 February, I am entirely in agreement with Mr Roullier's expansion of my previous comments on the pre-heating of drummed cable.

With regard to the question of moisture entering a joint, we too advocate wrapping the core joints with a non-adhesive self-bonding p.v.c. tape and we also recom-

mend that a further wrapping of similar material is tightly applied over the whole length of the joint.

With regard to the concluding paragraph in Mr Roullier's letter, tests have been carried out on 0·30 sq in. 4-core s.w.a. cable which revealed that the bond is capable of carrying short-circuits in the order of 50 to 60×10^6 amp²-second without any signs of distress, the resistance having decreased by about 5% to 10% after application of the test current. I agree that further tests are necessary for use with Solidal, and these are in hand.

J. K. Maynard, D.F.H., A.M.I.E.E.,
Development Engineer,
The Hepworth Iron Co. Ltd.,
Kingston-upon-Thames, Surrey.

Amateur Wiremen

I WOULD refer to the comments of "Socket Outlet" in the issue of 23 February. I do not agree that it is in order for handymen to carry out electrical installation work, even if they do follow advice given in home journals. Dangerous situations which can be created by amateur electricians in their home not only expose them and their families to danger, but future occupants of the house.

Furthermore, in many instances these people are not content to tamper with their own installations, but are quite happy to carry out extensions for others.

In my opinion, electrical accessories should not be permitted to be sold over the counter as at present by large multiple stores, where qualified advice is not available and in many instances the accessories are not of the best quality.

A short while ago I saw displayed in one such store a flexible lead complete with electric iron adaptor fitted at one end. The earth wire, where connected to the earth strip contact on the adaptor, had become disconnected. I drew the attention of the lady assistant to this, who, on my advice, removed the lead from the display counter; but I could not help thinking that some unsuspecting person may have purchased the lead and fitted a plug with disastrous consequences.

Engineer.

Europe's Supply Outlook

ELECTRICITY supply developments in the whole of Europe in 1959 and the earlier part of 1960 are reviewed in a report* prepared by the Committee on Electric Power of the UN Economic Commission for Europe.

For Europe, excluding the USSR, average electric power output per head of population is estimated at 1,330 kWh in 1959, compared with the world average of 710 kWh and a USA figure of 4,490. Comparative figures for 1958 were 1,250, 660 and 4,160. USSR figures for the two years are estimated as 1,180 and 1,070 kWh. Total gross consumption of electrical power in Europe, excluding USSR, is put at 595×10^9 kWh, a 7% increase on the preceding year and approximately 28·7% of total world production. USSR is estimated to have consumed 248×10^9 kWh and the USA 798×10^9 kWh, 11·9% and 38·2%, respectively, of world consumption.

The increase in electricity consumption during 1959 is closely related with an up-swing of industrial activity, and the rise was faster still in the first half of 1960. The report breaks off its review of consumption figures to discuss the influence of changes in temperature and industrial production of such statistics. The effect of temperature is most marked in predominantly thermal power countries. The UK is quoted as an example, with gross consumption varying by 2·1% for each degree C change in temperature, and 0·6% for each 1° variation in gross production.

The report analyses long-term trends in electricity consumption in five-year periods up to 1975. Most countries show some assumed decline in average annual growth rates at the end of the period, and five countries—Austria, Norway, Sweden, UK and USA—allow for a sharp fall in growth towards 1975. In fact, after 1970 it is found that, with the exception of the USSR, average annual growth estimates tend to be inversely proportional to consumption per inhabitant in 1975. On this topic, the report comments that during the post-war period there has been a widespread tendency to under-estimate future needs for electrical energy. This introduces certain dangers now that Government techniques for controlling short-term economic fluctuations are being widely applied in a climate of high capital investment and sustained economic growth.

In 1959 Europe's generating capacity increased by 9%. The desire for increased security of supply at peak demand times continued to be one of the main factors influencing the type of plant brought into service. Extending use of automatic control for thermal stations was apparent during the period reviewed, and there was marked attention to use of specialised plant for peak load tariffs.

Plant programmes for the period up to December, 1964, show that there will be 50% increase in capacity of plant in service compared with the beginning of 1960. Conditions are favouring re-examination of unused hydro resources in some countries, with an extension of the amount of thought worth exploiting.

Interconnection between systems in Europe is extending. By the end of 1959, excluding the very long 500 kV line in the USSR, European systems operating at voltages above 220 kV exceeded 9,000 km in length. This was over 6% of total transmission line length in service (110 kV and above). Cross-frontier exchanges of electrical energy reached $11·7\times10^9$ kWh during 1959, about 20% more than in the previous year. The situation of Switzerland was outstanding in this respect. The exceptional short-term combination of climatic conditions and rising internal requirements lead to a partial reversal of the normal seasonal pattern of net exports so that imports (from five countries) rose to more than one-fifth of total Swiss requirements over the five months begining October, 1959.

Recent developments have included progress with the programme for linking up by 1964 Czechoslovakia, Hungary, Poland and East Germany. This plan includes a connection between Czechoslovakia and Romania via the Ukranian Republic.

A feature of the report is an extensive appendix on development of gas turbine plants for public supply. This includes a table giving a list of 51 machines.

* "The Situation and Prospects of Europe's Electric Power Supply Industry in 1959-60," prepared by the secretariat of the UN Economic Commission for Europe. Obtainable from HMSO, price 7s.

Plastics and rubber for cables

BROAD RESEARCH ADVOCATED TO CONFERENCE

A BROAD programme of research covering not only development of plastics for cable sheathing and insulation, but also embracing improvements in jointing techniques and methods of laying, was suggested by Sir Christopher Hinton in his opening address to the second conference on rubber and plastics for cables, held at the Institution of Electrical Engineers last week. The conference was organised jointly by the Institution of the Rubber Industry and the Plastics Institute, and about 350 delegates attended.

Scope for the use of cables by the CEGB, Sir Christopher explained, was considerably less than by the area boards. The CEGB's annual expenditure on cables, mostly for connections between power stations and switching yards, was only about £3½ million whereas the area board's expenditure was between £28 million and £29 million. Cables became progressively more expensive as system voltages were raised. For example, two 275 kV cable links, each of 760 MW capacity, would cost £400,000 per mile, while the equivalent overhead lines would cost only £23,000 per mile. Only about £250,000 of the cost was directly attributable to the cable, the remaining £150,000 was needed for civil works associated with laying.

Amenity Value Only Justification

Sir Christopher emphasised that the only justification for the CEGB using cable, and very often the only justification for its use by the area boards, was to prevent harm to local visual amenities by "wirescapes." Public pressure was increasing for undergrounding, but responsible lay authorities had been convinced that the tremendous increase in cost for undergrounding was not justifiable. However, there was a tendency to increase undergrounding for the area boards' systems, especially those operating below 66 kV. There was no foreseeable future for undergrounding main transmission lines and, in fact, the number of overhead lines would probably increase considerably. By 1975 a wide mesh network operating at 750 kV might be needed to meet the growth in demand.

While the CEGB did not consider extensive undergrounding for transmission lines feasible, they were considering terminating the last half-mile or so of overhead lines through cables, especially near large switching stations. They had even investigated the cost of undersea cable links round the coast, but, again, the cost had proved to be prohibitive. Two investigations had been made, from the proposed Anglesey nuclear station and from the Kent station at Dungeness.

Although several promising plastics had appeared, they were too temperature-sensitive for high voltage operation. A material was also needed with low power factor, since, typically, a 275 kV paper cable could transmit no useful power if its length exceeded about 20 miles, unless expensive power-factor correcting plant was provided.

It was surprising that, after 70 years, no better material for insulation had yet emerged than impregnated paper, and Sir Christopher suggested that this fact, coupled with the limitations of the plastics so far developed, implied a lack of sufficiently imaginative research. It was well known, he added, that a research programme should deal with both the easy and difficult problems, for it was often from the more difficult and fundamental investigations that valuable leads were obtained. He therefore suggested a much broader basis for research into cable design, embracing not only new sheath and insulating materials, but also the civil and mechanical problems of providing simpler and less frequent joints, and the development of a cable suitable for mechanical methods of laying similar to those used for land drainage schemes. Plastics had, of course, the great attractions of being chemically inert and non-hygroscopic, suggesting that not only could the traditional lead sheath be dispensed with, but the armouring protection as well.

The cost of laying was underlined by figures he quoted for voltages in the distribution field. The cost of the cable was, he said, only from 40% to 60% of the total installation cost. For example, a 33 kV overhead line might cost £2,500/mile, whilst the equivalent capacity cable would cost £9,500 plus a further £6,000 for laying. At 66 kV, comparative costs would be £3,600 for an overhead line, £13,000 for the cable, and £7,000 for laying and jointing.

Even with these differences in cost, the area boards considered it their duty to underground many miles of line. Parity of costs was not, he said, essential to justify a swing from overhead to underground lines, but a large reduction of cost would certainly be necessary.

Properties Required of Plastics

Operating conditions of cables and their influence on the properties required of the dielectric were discussed by Mr Parkman (ERA) in his paper entitled "The Electric Properties of Polymeric Insulating Materials in Power Cables." The fundamental requirements were the suitability of a dielectric material to withstand electric stress, both at system voltage and for any over-voltages which might occur, and freedom from thermal run-away close to the operating temperature. The dielectric must be able to maintain thermal stability over the lifetime of the cable.

Polythene had an intrinsic dielectric strength of 6 MV/cm. If a ten-to-one reduction was allowed for over-voltages, the working stress reduced to 600 kV/cm. Yet, in practice, the permissible working stress rarely exceeded 30 kV/cm, comparing unfavourably with the 200 kV/cm permissible with impregnated paper cables.

The reduction in stress was enforced, both by deficiencies in the material and in manufacturing techniques, which could result, for example, in voids formation in the dielectric. Gas trapped in such voids had a lower discharge inception voltage than the dielectric, and this might produce increased stress in the dielectric with subsequent breakdown.

Paper was by no means a perfect dielectric material. Ensuring complete dryness was a great difficulty, and if the paper was not completely dry the oil impregnate was converted to wax, and subsequently pinholes formed

in the paper. The maximum operating temperature, normally taken as 80°C, could be increased to 160°C under short-circuit conditions, and even to 300°C for a very short time without charring occurring. Above a stress of 200 kV/cm, paper showed a sharply increasing loss factor and higher stressing was not practicable. Models of synthetic cables had shown some promising properties. Some had lower permittivity than paper and impulse levels up to twice as high. Good results had been obtained with polystyrene, but scrupulous cleanliness was essential during manufacture. In many ways p.v.c. was typical of the synthetic materials. The upper temperature working limit was probably not much greater than 80°C, and, although cables had been made for 20 kV operation, the material was not used for insulation much above 1,100 V. One advantage was that the lead sheath could be omitted, and, although p.v.c. cables were not much cheaper than paper cables, economies were possible through simpler jointing techniques. It had not yet been possible to exclude cavities in the dielectric during manufacture and there was a tendency to thermal instability.

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Personalities *in the industry*

Mr C. F. Richards

Mr R. McL. Fairfield

Mr C. Metcalfe

Mr P. A. Allaway

Mr J. Mills

A former co-founder of the Morphy-Richards' business, **Mr Charles F. Richards** is to be joint managing director of the new GEC Radio, Television and Domestic Equipment Group being formed under the proposed acquisition of Radio and Allied Holdings Ltd., to which we refer on page 385. The other joint managing director will be **Mr A. Weinstock,** who is managing director of R and A Holdings. Mr Richards, it will be recalled, unsuccessfully opposed the scheme for the acquisition of Morphy-Richards by Electric and Musical Industries Ltd. last year and subsequently resigned from the board "to pursue other interests." He had been a joint managing director since the formation of the company in 1936.

Mr R. McL. Fairfield, M.A., M.I.E.E., A.M.I.MECH.E., has been appointed a director of Submarine Cables, owned jointly by Associated Electrical Industries Ltd. and British Insulated Callender's Cables Ltd. **Mr H. F. Wilson** retires from the board. Mr Fairfield was appointed assistant managing director of BICC last year, having joined the board in 1954 as director of production and engineering, and later as director (home operations).

Mr L. J. T. Weston, A.M.I.E.E., construction engineer to the Suffolk sub-area of the Eastern Electricity Board, and formerly mains superintendent to the Ipswich Corporation Electric Supply and Transport Department, is going to Milan in October and will stay in Italy for two months with Societa Edison Milan. The visit has been arranged by the Electricity Council under a scheme whereby personnel in the electricity supply industry are exchanged for limited periods with their opposite numbers in overseas countries. Mr Weston has a good knowledge of French and an elementary knowledge of Italian; he also speaks Urdu, having learned this language while he was in India from 1935 until 1946 with the Calcutta Electric Supply Corporation and also serving in the Indian Electrical and Mechanical Engineers as a major.

Mr D. H. Fisher has resigned his position as production and technical director of Magnavox Electronics Ltd.

Formerly with Rank Precision Industries Ltd., **Mr R. S. Pryor** has joined Atlas Lighting Ltd. as sales supervisor for their Photographic Department.

Mr A. N. East, C.B.E., M.I.E.E., M.I.MECH.E., ASSOCIATE I.C.E., has ceased to be a member of the Eastern Electricity Consultative Council, a post he has held since retiring from the position of chief engineering inspector to the Electricity Division of the Ministry of Fuel and Power in August, 1953. Most of his experience, of course, was gained with the Electricity Commissioners, whom he joined in 1920.

At his own request, **Mr C. Metcalfe,** C.B.E., is to relinquish the position of managing director of EMI Electronics Ltd. on 1 July next, in which capacity he will be succeeded by **Mr P. A. Allaway.** Mr Metcalfe will remain a full-time director of Electric and Musical Industries Ltd. and will be mainly concerned in initiating technical and development policy for new products. He joined the Gramophone Co. in 1930 as a mechanical designer, was appointed a director of EMI Engineering Development Ltd. in 1946, and managing director in 1954. He became managing director of EMI Electronics Ltd. in 1956. Mr Allaway joined the Gramophone Co. in 1930. After considerable experience on mechanical and electrical projects, he spent the war years designing equipment for radar and similar electronic devices for the armed services. After the war, he transferred his activities to the domestic appliance side of EMI and, under Mr Metcalfe's direction, built up a large number of new designs for these appliances. He was appointed general manager of EMI Engineering Developments Ltd. in 1953, and works director in 1956. When EMI Electronics was formed under Mr Metcalfe, to integrate the Group's activities in military electronics and industrial capital equipment, Mr Allaway was appointed works director. In 1957 he became deputy managing director of the company.

Mr K. A. Robinson, A.M.BRIT.I.R.E., has been appointed to the board of Lancashire Dynamo Electronic Products Ltd. He joined that concern as chief development engineer in 1948, was appointed chief engineer in 1959 and, lately, has assumed responsibility for marketing. Before joining the company, Mr Robinson was concerned with the development of industrial electronic equipment with the English Electric Co. at Stafford. His earlier training was with the Mullard Radio Valve Co.

Mr R. B. Pringle, C.A., has been appointed assistant chief financial officer (chief internal auditor) of the Central Electricity Generating Board to succeed **Mr J. R. Tait,** C.A., who will shortly be retiring.

With the retirement of **Mr J. E. Shepherd,** M.I.E.E., A.M.C.T., to which we referred last week, **Mr J. Mills,** A.M.I.E.E., M.I.MECH.E., A.M.C.T., M.INST.F., has now assumed full responsibilities as manager of the North Western Electricity Board's No. 6 sub-area. Mr Mills has had wide and varied experience in the electricity supply industry. Originally with the Lancashire Electric Power Co., he moved in 1936 to Bradford where he was generating engineer at the Valley power station. Returning to Lancashire

in 1943, he became station superintendent and later deputy borough electrical engineer at St. Helens, Lancashire. He was subsequently borough electrical engineer and manager at Bury, and was purchasing officer to the Board from 1948 to 1953. Before taking up his new appointment in Kendal, he was manager of the Board's No. 7 sub-area.

The Electrical Research Association now announces the composition of its Divisional Committee No. 3—switchgear and transformers for power supply—which recently held its inaugural meeting: **Mr J. Christie,** chairman (A. Reyrolle and Co.); **Mr R. B. Brown** (Southern Electricity Board); **Mr D. M. Cherry** (CEGB); **Mr J. S. Cliff** (General Electric Co.); **Mr T. E. Daniel** (North Western Electricity Board); **Mr J. L. Egginton** (CEGB); **Mr J. M. Ferguson** (English Electric Co.); **Mr C. H. Flurscheim** (AEI (Manchester) Ltd.); **Mr C. C. Hill** (Eastern Electricity Board); **Mr R. M. Hobill** (Ferranti); **Dr S. Jones** (CEGB); **Mr H. Leyburn** (A. Reyrolle and Co.); **Mr A. E. Nicol** (Hackbridge and Hewittic Electric Co.); **Mr E. C. Rippon** (C. A. Parsons and Co.); **Mr T. R. Warren** (South of Scotland Electricity Board); and **Mr T. W. Wilcox** (Merz and McLellan). **Dr H. G. Taylor,** director of the ERA, is an ex-officio member of the committee, and the secretary is **Major E. D. Gardner,** of the ERA.

District commercial engineer in the Consett district of the North Eastern Electricity Board, **Mr C. W. Starkey** has left to become assistant to the Harrogate sub-area commercial officer. His friends at Consett made a presentation to Mr Starkey.

Machine Shop manager at the General Electric Co.'s Erith works, **Councillor J. S. R. Wise** has been nominated as the next mayor of Dartford.

Lord Chandos, chairman of AEI, has been re-elected president of the Locomotive and Allied Manufacturers' Association, with **Mr G. Collingwood,** T.D., managing director of Vulcan Foundry Ltd., again as chairman for the ensuing year.

AEI Lamp and Lighting Co. have combined their North West and North East sales regions into one sales territory known as the Northern region. Manager of this new territory is **Mr G. W. Nattrass,** formerly manager of the North Eastern territory. His deputy, pending retirement in 1962, is **Mr F. C. Tyrrell,** previously manager of the North Western region, and his assistant manager is **Mr J. K. Frisby.** He held a similar position with the North Eastern region. Mr Nattrass's office will remain at 46 Wellington Street, Leeds, the headquarters of the new region. The addresses of the company's area and other offices in the territory remain unchanged.

The EAW's Elizabeth Sloan Chesser Cup has been won by **Mrs R. M. Robinson,** of the South Eastern Electricity Board, Twickenham, who gained the highest mark in the tests of the Association's Diploma in Electrical Housecraft during 1960. The joint runners-up were **Miss M. I. Ralphs,** Midlands Electricity Board, Kidderminster, and **Mrs A. P. J. Coates,** also of MEB, Worcester.

His many friends in the industry will be glad to know that **Dr W. J. Gibbs,** D.SC., M.I.E.E., of AEI Ltd., who was taken to hospital following last week's conference on rubber and plastics cables in London, is now making satisfactory progress.

Mr W. Theaker has been appointed street lighting superintendent and passenger transport supervisor to Heywood Corporation. Since 1950 he has been with Oldham's Street Lighting Dept. and, earlier, was with the North Western Electricity Board.

The Minister of Power has reappointed three part-time members of electricity boards. They are **Mr J. F. Stanier** (EMEB); and **Mr E. J. Hunter** and **Mr E. T. Judge** (N Eastern EB).

The Merseyside and North Wales Electricity Board have appointed two new district managers in No. 4 sub-area. **Mr J. A. Winchester,** now manager of the Conway district, becomes manager at Crewe in succession to **Mr A. D. Hegan** who retires in July. **Mr J. L. Williams,** at present district manager at Aberystwyth, will shortly assume responsibilities for Oswestry district from **Mr W. A. Williams** who is soon to retire.

OBITUARY

Mr S. H. Chase, M.I.E.E., formerly assistant sales manager, Stationary Battery Division, of Chloride Batteries Ltd., died on 12 Feb., less than five years after retiring.

Mr J. T. Morgan, secretary of the Association of Electrical Machinery Trades since its formation in 1944, died on 27 Feb., aged 59.

Mr B. L. Watson, vice-chairman and managing director of Teleflex Products Ltd., died on 28 Feb.

TWO I.E.E. AWARDS

THE Council of the Institution of Electrical Engineers have elected to honorary membership **The Rt Hon the Lord Nelson of Stafford,** LL.D., F.C.G.I., HON.D.I.C., M.I.MECH.E., and have awarded the Faraday Medal to **Dr Julias A. Stratton,** SC.D., LL.D. The honorary membership bestowed upon Lord Nelson is "in recognition of his outstanding contribution to the development of electrical science and engineering, and for his many services to the IEE." Lord Nelson was created a Baronet in 1959, and raised to the peerage last year. He has been chairman of the English Electric Co. Ltd. since 1933—three years after he joined the company as managing director. He took his diploma at the City and Guilds Technical College before he was 18 years old. He was awarded the Mitchell Exhibition and a post-graduate Brush studentship, and became a pupil with the Brush Electrical Engineering Co. At 22 he was their chief outside engineer, but later joined the British Westinghouse Co. (afterwards Metropolitan-Vickers Electrical Co.) and, by 1920, he had established and become manager of their Sheffield works, a post he held till joining EE Co. He first became an Ordinary Member of the Council of the IEE in 1949, was elected a vice-president in 1950 and was president in 1955. He achieved the rare distinction of serving both as president of the IEE and of the mechanicals in 1957-58. He has also been president of the Locomotive and Allied Manufacturers' Association (1958) and of the Federation of British Industries (1943-45) and he has been a member of the latter's Grand Council for the past 14 years. He is a Governor of Queen Mary College, University of London, and an honorary member and Fellow of Imperial College of Science and Technology.

Lord Nelson

The Institution's award of the Faraday Medal to Dr J. A. Stratton is "for his notable contributions in the field of technological education and research in radio communication." Dr Stratton, who has been president of the Massachusetts Institute of Technology since 1959, took his M.Sc. and Sc.D. degrees there. He was employed as a research associate in communications at the MIT, became assistant professor in electrical engineering in 1928, assistant professor of physics in 1931, and was associate professor from 1935 to 1941. Four years later he became director of the Research Laboratory (electronics), was vice-president from 1951 to 1956, and chancellor from 1956 to 1959.

Dr Stratton has made an outstanding contribution to the theory of transmission line, waveguide and antenna systems in relation to the wartime development of centimetre-wave radar.

MATERIALS FOR ELECTRICAL DESIGN

COATED GLASS FABRIC

INTENDED for use as an electrical insulator, Tygaflor coated glass fabric type A is made by applying a smooth uniform and continuous coating of p.t.f.e. on woven glass fabric. The material has dielectric constant of about 2·6 and dielectric strength of up to 700 V/mil for short-time application. The surface is arc resistant and is inert to chemicals other than molten alkali metals, fluorine and chlorine trifluoride. Temperature resistance is satisfactory between the range 250°C and −100°C, and moisture absorption is low. The coated fabric is available with about 60% p.t.f.e. coating by weight, brown in colour. *Fothergill and Harvey, Harvester Hse, Peter St, Manchester 2.*

Continuously Coated Fabric Properties

PTFE coating by weight	Approx. 60%
Colour	Brown
Dielectric strength ...	200-700 V/mil (depending on type of material)
Thickness	0·003 to 0·010 in.
Width	½ in. to 37½ in.

IMPROVED MICA ADHESIVE

DEVELOPMENT of an improved adhesive for mica washers is claimed by the Anglo-American Vulcanised Fibre Co. The new material is an epoxy type, having a much higher temperature than the shellac previously used for the job. It is now possible to use the company's built-up mica washers for temperatures up to 200°C. *Anglo-American Vulcanized Fibre Co., Clayton Wks, Bath St, E.C.1.*

PROTECTING STEEL WORK

NEW tables showing thickness of vermiculite/gypsum plaster for fire protection of structural steel work have been calculated by the Fire Research Association. Information on these figures is available from *Expanded Metal Co. Ltd., Burwood Hse, Caxton St, S.W.1.*

PLASTICS PIPES FOR CABLES

PLASTICS sleeving has been applied on a London railway bridge to replace mild steel pipes carrying 66 kV oil-filled cables. Severe corrosion of the steel pipes had been experienced due to sulphurous fumes emitted by steam trains passing under the bridge. Cables were served with a bituminous hessian covering and weighed 70 lb/yd, making them 4·14 in. o.d. Thirty-six 10 ft lengths of thermoplastics piping of about 9/32 in. wall thickness were cut in half longitudinally for site installation. Experiments show that the pipe could be effectively resealed by chamfering the longitudinal cuts to a depth of half radial thickness and welding in a triangular section of p.v.c. fillet using an electrically heated nitrogen welding gun. Lengths of tubing were joined by a bell and spigot method, in which one end was "belled" by factory preheating to accept the next length to a depth of about 2 in. A solvent cement and welding was used to seal off the length. *Durapipe and Fittings Ltd., West Drayton, Middx.*

FLAMEPROOF FIBREBOARD

FIBREBOARD flameproof throughout and moisture-resistant is claimed to result from a pressure impregnation process that is based on "Pyrolith." The material has been called "Pyrestos" Dribord, and possesses enhanced resistance to moisture absorption as well as non-flammability qualities. The manufacturers claim the material has achieved Class I rating for flame spread and it does not support flame when subjected to the appropriate BS 476 test. Density and sound absorption are unaltered from those of untreated fibreboard. The material is suitable for use in its natural state, offering a pale fawn colour or painted. *Marketed by Pyrestos Ltd., 8 Buckingham Palace Gdns, S.W.1, and manufactured by Board Processors Ltd., Leyborne Wharf, Horton Bridge Rd, West Drayton, Middx.*

SILICONE COMPOUND DETAILS

DETAILS of MS 4 silicone compound are set out in a new leaflet published by the manufacturers. Principal uses of this material are as a dielectric potting material for transistors and other electronic equipment; as an auxiliary dielectric in ignition systems; and as a lubricant. It may also be used to seal electric heating elements, aerial connectors, etc., against moisture ingress, and for prevention of corrosion on battery terminals. This material was recently the subject of price cuts. *Midlands Silicones Ltd., 68 Knightsbridge, S.W.1.*

Electrical Properties of MS 4 Silicone

Volume Resistivity, up to 200°C (392°F), ohm cm	10^{12}
Permittivity, between 100 c/s and 10 Mc/s	2·8
Power Factor, between 100 c/s and 10 Mc/s	0·001
Electric Strength at 10 mil, volt/mil...	Min. 500

MS 4 is being marketed in an aerosol pack under the name Ambersil MS 4 by *Amber Oils Ltd., 11a Albemarle St, W.1.* 12 oz tins in this form cost 15s singly, reducing to 10s per tin for orders of one gross.

MOULDED CEILING

FOLLOWING success with 16 in. tiles, the Paragrid-Tile injection moulded polystyrene ceiling is now being made available in 24 in. square tiles. The new tiles will be known as "Paragrid 24." Size of the louvre cells and method of suspension remain the same as with the 16 in. tiles. The number of suspension points for the channels in which the tiles are held is reduced from six to four for an 8 ft length. *Harris and Sheldon Electrical Ltd., 31 Stafford St, Birmingham 4.*

ANTI-STATIC FLOORING

AVAILABLE for flooring where build-up of static electricity has to be countered is Phengard, manufactured by compounding carbon black. Phengard is made in two classes. One a hospital grade is sufficiently conductive to ensure rapid dissipation of charge, while the industrial grade may be applied where protection against l.t. shock it not necessary. The flooring is prepared on a base network of 2 in. brass foil strip. At present the material can be supplied in black only, but the possibility of making available colours is the subject of investigation. *Phoenix Rubber Co., Ltd., Slough, Bucks.*

SEALING CABLE JOINTS

SPECIAL compositions, based on "Epikote" epoxy resins, for sealing cable joints have been developed by Shell Chemical Co. These compositions cure quickly at ambient temperature to form a water-tight sealing around the joint. The resulting casting has toughness, impact strength, resistance to water and thermal cycling, and the generally good electrical properties characteristic of Epikote resins. The cable jointing compositions are claimed to be particularly suitable for use with p.v.c.-insulated cables. Since the resin generates its own exothermic heat during cure, joints can be made at ambient temperature without use of heating equipment on site. *Shell Chemical Co. Ltd., 15 Great Marlborough St, W.1.*

DATA ON GLASS

INFORMATION on applications of Pyrex glass are to be given in a new bi-monthly technical bulletin. The first number describes work with Pyrex electrically-conducting coated tubes, in control of temperature in experiments. *James A. Jobling Ltd, Wear Glass Works, Sunderland.*

LAMINATED SHEETS

INDUSTRIAL laminated plastics sheets manufactured by Skanska Attikfabriken AB of Perstorp, Sweden, are now available on the UK market. The range covers both paper and fabric-based types, the former being supplied with copper cladding if required for printed-circuit manufacture. Grades are available manufactured to BS specification and also to DIN (German) and NEMA (USA) standards. *Perstorp Products (Great Britain) Ltd., High St, Orpington, Kent.*

Rail electrification in India

by A. E. Williams, Ph.D., F.C.S.

THE first use of electricity on Indian railway systems was for an installation of arc lamps at Howrah station, Calcutta, in 1896. Within a year the practice spread to all major stations in the country. Electric lighting, using carbon filament lamps, was gradually introduced into railway offices and workshops in the main towns and, at the turn of the century, also began to replace oil for train illumination, using belt-driven generators coupled to the rolling stock axles.

India is a large country and, naturally, electrical development has been slower than in the smaller European countries. An early problem was to find enough generators to meet demands from all the areas calling for supply. Eventually, with increased generating efficiency and the introduction of turbo-alternators and hydro-electric plants, it became possible to consider electric traction for the railways. In 1913, the authorities in the Bombay area had come to the conclusion that electrification was the only solution to the growing traffic problem, but, with the advent of the first world war, the project had to be shelved. It was not until the early 'twenties that the first rail electrification scheme was commenced.

First Steps

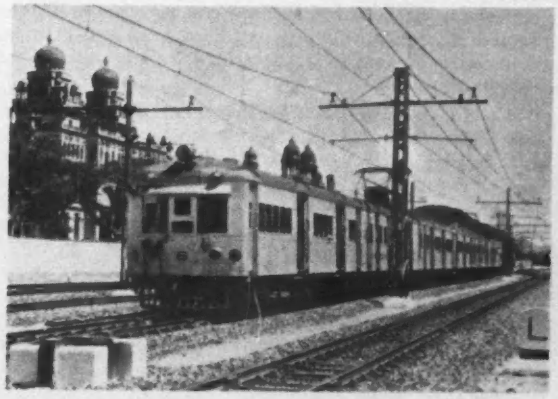
The initial section to be electrified was from Bombay (Victoria) to Kurla, a distance of about ten miles. This came into operation in 1925 and was extended to Kalyan, 24 miles further on, by 1928. It was a d.c. system, 1,500 V, with equipment supplied by English Electric. Rolling stock comprised 102 driver-trailer coaches, 51 trailer coaches and 53 motor coaches, the latter having four 300 h.p. motors connected permanently in series pairs across the supply, which was collected from the overhead catenary system by pantograph collector. There were two pantographs to each motor coach, only one of which was in service at a time.

Electrically operated camshaft contactor equipment provided the motor control and was installed in a compartment at one end of the coach. The stock was made up into train units comprising one motor and one trailer coach sandwiched between two driver-trailer coaches. In peak periods, two units were coupled to give a total seating capacity of 874, or, with standing passengers, over 1,000.

From Bombay to Kurla, where traffic is densest and stops under a mile apart, the average speed is 26 m.p.h. with scheduled stopping intervals of 30 sec. Supply for the trains is derived from a number of 1,500 V rotary converter units, each comprising two 1,250 kW, 750 V d.c. machines in series. These draw their a.c. supply mainly from the Kalyan power station.

The initial electrification was the work of the GIPR, now part of the Central Railway, and electrification of the 20-mile Bombay-Borivli route, commenced shortly after, was carried out by CIR, now part of the Western Railway. Again, British equipment was used for the major part, such firms as BTH, Metropolitan Cammell Carriage, Birmingham Railway Carriage and Wagon, and British Insulated and Helsby Cables contributing. In fact, these companies, together with English Electric and Metropolitan Vickers, have been responsible for most of the electrical equipment in India up to the present.

The normal four-coach unit on the BCIR route from Bombay was made up from two trailer coaches sandwiched between two driver-motor coaches. The stock is fitted with Westinghouse self-lapping electro-pneumatic brakes, and it was the first time that air brakes were used on multiple-unit stock in India. The stock had to meet difficult climatic conditions, with shade temperatures rising at times above



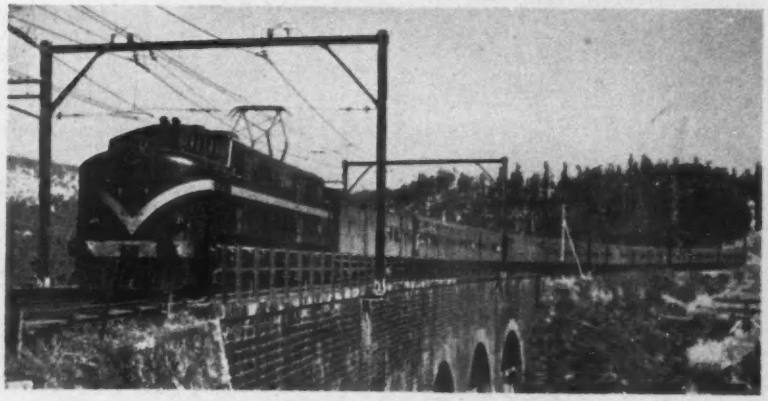


Fig. 1. Above, two 3-coach units on the Madras suburban service

Fig. 2. Right, a 3,600 h.p., 1,500 V d.c. locomotive drawing the Poona express and negotiating a curved gradient on the main line from Bombay. Note the compound catenary overhead suspension

100°F and humidities up to 100%. During the monsoon season the rainfall may be intense and the tracks can become flooded, often causing breakdown through water extinguishing the locomotive fires. With electric traction, the motors are ventilated in the usual way, but the openings are so designed that they can be closed when passing through flooded areas, while special air valves enable them to operate even when the track is under 2 ft of water.

These two electrified routes in the Bombay area gave complete satisfaction, but they gradually became inadequate for the traffic they had to handle. Additional stock, comprising 28 four-coach units, was purchased and 12 allotted to the BCIR, with the remainder going to the GIPR. By careful design, a saving in weight of about one ton per motor coach was achieved in the electrical equipment alone. Motors are hung with resilient nose suspension and are fitted with roller armature bearings, sleeve suspension bearings and Class B insulation. They are of the self-ventilated pattern and are fitted with two fans drawing air from inside the coaches and exhausting through cowls shaped to exclude splash when the track is flooded. Motors are connected in series pairs which, in turn, are controlled in a series-parallel system with multiple unit control, enabling a 12-coach train to be regulated from the one driving position.

The h.t. compartment is interlocked with the main isolating switch and it is not possible to enter until the switch has been opened and earthed. The h.t. equipment is enclosed in a cubicle within the compartment, access to which is prevented unless the pantograph is lowered and the auxiliary isolating switch opened and earthed. With the h.t. compartment open and the main isolator earthed, but with the auxiliary isolating switch still closed, the pantograph may be raised to provide current for the auxiliary services. The motor generator set, mounted on the underframe, is waterproof to flood level and batteries are housed in ventilated, watertight boxes also on the underframe.

The m.g. set provides 120 V d.c. for traction control, electro-pneumatic brakes, fans, emergency lighting and also charging current for the 78-cell Ni-Fe 40 Ah battery. Voltage regulation is by vibrating carbon pile pattern, and the usual reverse current relay and contactor is provided. An inductor alternator, overhung on the l.t. end of the m.g. set, provides a 400 c/s, 210 V supply for train fluorescent lighting.

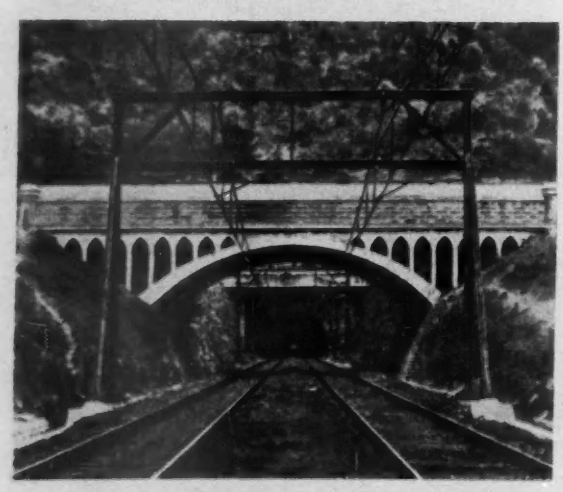


Fig. 4. The approach to the Parsik tunnel on the electrified loop line between Thana and Diva

Fig. 3. Preparing the mast foundations on the Tatanagar-Rourkela route. The cylindrical template in the foreground will be set in the ground and concrete poured around. When set, the template is removed to reveal a solid foundation for an overhead suspension mast

Long-distance Trains

Electrification of the two Bombay suburban routes was followed by the introduction of electric traction on the 119-mile Bombay-Poona and 85-mile Bombay-Igatpuri routes, these being extensions to those electrified routes already existing in the area. On these sections, locomotives are used instead of multiple-unit stock, despite the numerous gradients, wide gauge (5½ ft) and correspondingly large coaches. The locomotives were supplied by the English Electric Co. for both passenger and freight trains on the routes, which include lengthy 1 in 40 gradients and sharp curves.

The locomotives are of 3,600 h.p., 1,500 V d.c., with regenerative braking, exerting a maximum tractive effort of 69,000 lb, or 38,900 lb continuous at 30 m.p.h. They will draw a 560-ton passenger train on a level track at 68 m.p.h., or at 29 m.p.h. on a 1 in 37 gradient. For freight haulage, the comparable figures are a 2,000-ton train at 30 m.p.h. on a 1 in 100 gradient.

The overhead catenary system is used throughout the Indian railways, with compound catenary suspension on main lines and single catenary suspension on suburban lines between Bombay and Borivli. On the Bombay-Kalyan route, compound catenary suspension is employed.

Madras Area

Electrification in the Madras area commenced in 1929 with the placing of a contract for equipment with the English Electric. The project included not only the electrification of existing lines but also the construction of new tracks and stations to handle the vastly increased traffic. Double track for 18½ miles between Madras and Tambaram and a number of shunting yards to facilitate freight handling were part of the project, which was completed in 1930. Rolling stock included 17 three-coach articulated units—one motor and two trailer coaches—arranged for multiple-unit working and four locomotives with two battery tenders for freight handling.

The equipment was designed to maintain an average speed, fully loaded, of 40 m.p.h. over the whole route, with average stop intervals of 1½ miles. A three-coach unit incorporates four 122 h.p. motors in series pairs, one pair mounted on each of the intermediate bogies. Motors are self-ventilating, drawing air from inside the coach near the roof through ducts to combat the prevailing dusty conditions. The four locomotives are of the 0-4-4-0 type with two nose-suspended, axle hung, 160 h.p. motors and

articulated bogies. As in the Bombay area, the system is 1,500 V d.c.

Calcutta System

Saturation of the steam railway system in the Calcutta hinterland, West Bengal and Bihar areas was reached by the end of the second world war. The decision to electrify, at 3,000 V d.c., was taken early in 1954, and track equipment, rolling stock, etc., was placed to tender in 1955-56. For the Howrah-Burdwan section, an order was placed with English Electric for 12 111-ton, 3,120 h.p. locomotives, the first at 3,000 V in India, designed for a maximum service speed of 70 m.p.h. This system was inaugurated in December, 1957, and is being extended.

The locomotives for this section comprise a single superstructure carried on two three-axle bogies in which each axle is driven through single reduction gears of the resilient spur type by a nose-suspended, axle-hung traction motor. A driving cab is at each end of the superstructure and is protected by a nose compartment. The locomotive can, therefore, be driven equally well from either end in both directions of travel. Access to each driver's cab is provided by a door on each side of the locomotive. A compressor and exhauster are housed in each nose compartment, together with associated contactors and resistance units. Entry to the compartment is via a central door.

High-tension control equipment is housed in two equipment frames mounted in the main body compartment, together with two main starting resistance frames and two m.g. sets. Each h.t. frame forms a compartment with bulkheads and the locomotive sides. Access to the compartments is via doors in the bulkheads, which are mechanically interlocked with the pantographs and main earthing switches.

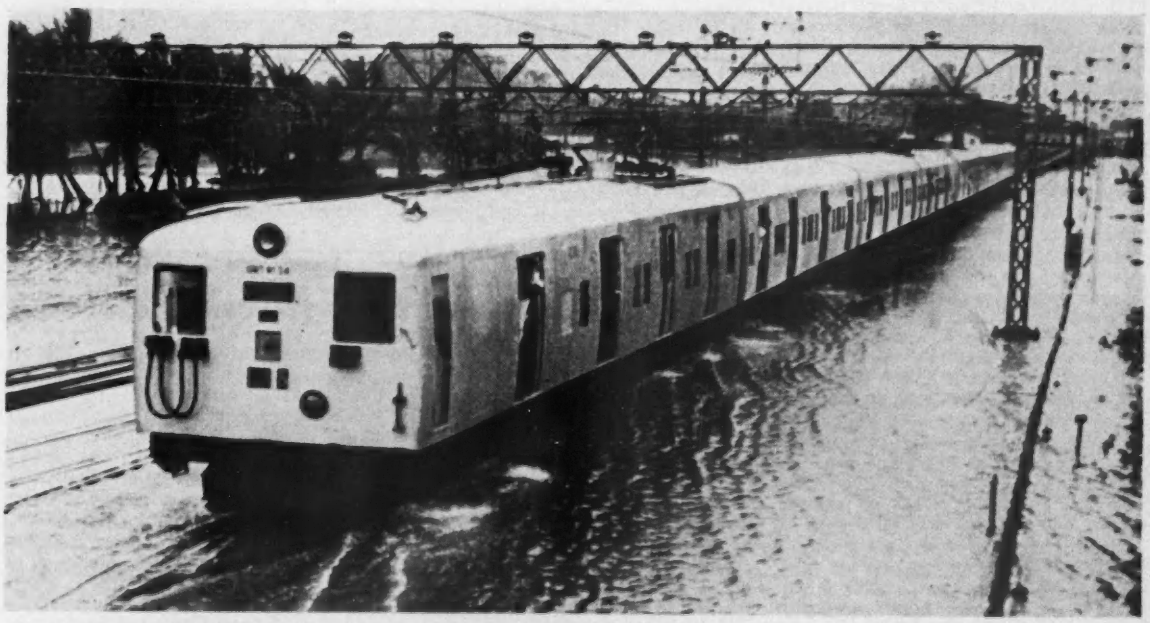
Each locomotive incorporates six force-ventilated motors of 520 h.p. at the one-hour rating attached to the bogie transom by a resilient nose-suspension and supported at the axle by journal bearings. Each motor is equipped with an isolating switch enabling the locomotive to be driven by the remainder—a standard Indian practice—and two motor generator sets with blowers for cooling the motors and ventilating the h.t. compartments are also provided on each locomotive.

Pneumatically operated pantographs with lightning protection and double pans provide connection to the catenary system, and braking equipment is of the air/vacuum type with Westinghouse compressors and Northey exhausters. The braking system is arranged for automatic application of the straight air brakes on the locomotive and through a vacuum/air proportional valve for the vacuum brakes on the train.

Other Projects in Hand

Schemes currently in hand involve electrification of more than 1,000 miles on the modern 25 kV a.c. system, with priority of conversion on routes handling passenger and greatly increased freight traffic. By the end of 1960, routes in service and electrified were from Rajkharsawan to Dangoaposi (47 route miles), Asansol to Dhanbad with a branch to Pathardih (49 route miles), with wiring completed between Asansol and Chakradharpur and the branch to Tatanagar, and work well in progress on routes to Rourkela, Gaya and Burdwan, where it connects with the 3 kV d.c. Howrah line. A project is also in hand for electrifying the route from Madras to Villipuram via Egmore and Tambaran on the same a.c. system.

In 1958 a £2¼ million contract for 25 kV overhead line equipment, including installation, was awarded to the BICC group and covered about 420 miles of track. A large proportion of this has already been erected on the above routes, linking the iron ore fields in Bihar with the existing steel plant at Tatanagar and the newly completed plant at Rourkela. The overhead equipment comprises 107 sq mm electrolytic contact cable suspended from 19-strand cadmium copper catenary, which is supported by cantilever brackets swivel-mounted on galvanised steel masts. Tension in the conductors is kept constant by means of balance weights. The Indian authorities have decided to standardise on the 25 kV, 50 c/sec, single-phase a.c. system for all future railway electrification.



A typical scene on Indian railways in the monsoon areas. Here a 700 h.p., 1,500 V multiple-coach unit is passing through a flooded track area in the Bombay suburbs, conditions for which it has been specially designed and which frequently brought steam services to a standstill

ADVANCED STEAM CONDITIONS

Short-term Prospect in British Power Stations

DESPITE the placing of orders for two 375 MW supercritical units, steam conditions in the CEGB's power stations are unlikely, in the near future, to rise generally above the 2,300 lb/sq in., 1,050°F standard now being used for stations under construction or in the design stage. This was stated at a discussion on the value of advanced steam conditions, held last week at the Institution of Mechanical Engineers. Consolidation of knowledge with these advanced steam conditions is likely to set the future pattern, with attention paid to such design-influencing factors as the reduction of losses in the feed system and whether utilisation of heat from hydrogen coolers is economically justifiable.

Difficulties

Apart from the size of the sets now being designed, which posed its own difficulties, specific problems arose from the advanced steam conditions. For instance, the need to design adequate bolts and joints, and whether to incorporate a reheat by-pass for hot starts. Limitations of blade design were important, particularly at the low pressure end where it might be necessary to sacrifice some efficiency to ensure a sufficiently rigid blade form. Methods of blade fastening also became particularly important at the l.p. end.

In America, the tendency now was to retreat to steam conditions similar to those used in this country. A development there was the use of double reheat, giving 1% to 1½% increased efficiency over single reheat units. Six stations were believed to have double reheat sets.

The CEGB's decision to use larger sets was directly related to the sharp rise in electricity demand which had occurred in the years since the second war. So far this winter the peak demand had almost reached 25,000 MW, an indication of the enormous generating capacity required. In fact the increase in size of sets over the years had followed a curve remarkably similar in shape to the demand curve. Availability was a matter of concern with such large units, since the loss of a 300 MW set and the use of less efficient plant to make up the deficiency, cost about £2,000 for every 24 hours that the 300 MW set was out of action. The design efficiency of the 375 MW sets now under construction was calculated to be 39·8% and although a reduction of 2% was made to give the operating efficiency, so far on sets in service, station staffs had been able to approach the design figure more nearly.

Significant reductions in cost per MW installed were possible by using larger units, one of the main reasons being that the overall size of a 200 MW boiler was smaller in proportion than, for example, a 30 MW unit. The set size/unit installed capacity was also reduced considerably and improved design techniques had made possible weight reductions/MW of 7:1 for a 500 MW set, compared with a 30 MW unit, notably by water and high pressure hydrogen cooling.

One speaker quoted production man hours per unit output as 42% for a 500 MW set and 62% for a 100 MW reheat set compared with 100% for a 30 MW unit.

Standard Conditions

The choice of 2,300 lb/sq in. and 1,050°F was based on extensive design studies undertaken by the CEGB and the desirability of eliminating as far as possible use of austenitic steels. Complete design studies had been made on boiler designs up to 5,000 lb/sq in. and these had indicated 2,300 lb/sq in. as the next step above 900 lb/sq in. and 1,500 lb/sq in., 2,300 lb/sq in. at the t.s.v. implied a drum pressure of 2,600 lb/sq in. approaching the 2,800 lb/sq in. limit, considered safe for emergency operation of a natural circulation boiler. Natural circulation was not, of course, essential, and the CEGB had no particular preference for either natural or pumped circulation. Both types were in service and it seemed likely that the additional pumping cost might well be offset by the lower cost of tubing. The next logical step would seem to be a 375 MW supercritical set operating at 3,500 lb/sq in. At such supercritical pressures the weights of steam and water differed only slightly and forced circulation was essential, since any slight difference in head which might occur would not be sufficient to overcome water friction in the tubing.

USA Experience

Experience with high pressures in the USA referred to by several speakers, centred on the plant at Philo. There, trouble had been caused by glands on the feed pumps, welding of austenitic steel, and copper migration on to the turbine blading, causing end-thrust and out-of-balance running. All but the last difficulty would seem to have been overcome, but this was not suspected until the turbine was opened after a prolonged period of operation. The copper had presumably come from the feed heaters and it was suggested that ferric feed heaters and condensers or even a stainless steel design, following the lead given by nuclear engineers, might overcome the trouble. The use of stainless steel in some US stations for the feed heaters was confirmed by another contributor who added that, as with stainless steel welding was comparatively easy, it was difficult to understand why copper was still used. He also commented that a very high degree of feed water purity was essential, and suggested that filtering was better than purification by base exchange.

Referring to operating pressures, he said in the US it was not considered profitable to exceed 2,500 lb/sq in. Although an increase of 6% to 7% in efficiency was possible by doubling the operating pressure, this was partially counteracted by increased pumping power at the rate of 1% efficiency for every 1,000 lb/sq in. rise in pressure.

The CEGB were stated to have been using steel feed heater tubes for some time and they considered that water purity with base exchange was acceptable for supercritical operation. They recognised the importance of cleanliness in the entire water system for advanced steam conditions. Practice was to use alkali, acid, and then a further alkali cleaning cycle, followed by nitrogen filling to exclude oxygen until the boiler was brought into service. Under service conditions, the protective oxide coatings formed became sealed to the tubes.

Electrical Engineers for Aircraft Industry

TRAINING desirable for electrical and electronics engineers intending to work in the aircraft industry was discussed last week at a joint meeting of the IEE and the Royal Aeronautical Society. Opening the discussion, Mr G. S. Bosworth, director of Group Personnel Services with English Electric, traced IEE requirements for the training of all electrical engineers. He pointed out that the IEE felt that a young engineer should, during his post-graduate training, continue his technical studies by directed reading or attendance at post-graduate courses. However, the Institution realised that the general pattern laid down had to be modified to meet different conditions in industry, and that requirements of the manufacturing side of the aero industry would be different from those where operation and maintenance was the main concern.

In the earlier part of his introduction, Mr Bosworth had emphasised the importance of the young engineer obtaining as broad as possible an education in mathematics and science; this is necessary because of the rate of progress in engineering, which makes versatility and adaptability essential.

Appliances at Olympia

FLOOD OF NEW DESIGNS AT IDEAL HOME EXHIBITION

A FLOOD of electrical appliances for the home with many new and some revolutionary designs are immediately evident at the Ideal Home Exhibition, Olympia, this month. Manufacturers are constantly striving to bring new models to the market, a trend which is especially marked in the fields of cookers, refrigerators and washing machines. The accent, too, is on appliances for the flat dweller or those with limited kitchen space, and two firms are showing models using wood veneers on the exterior, one is a vacuum cleaner and the other a refrigerator, either being suitable for the living-rooms.

Competition between firms in the cooker market is revealed by the number of these units on show, each vying with the others to make new additions and adaptions. The kitchen, ever-important in the home, has been made the subject of exhibits by six manufacturers, who are showing not only their latest equipment but the best methods of placing and using them. The importance of electricity in the home is stressed by the Electrical Development Association's stand, where the familiar theme is "Plug in to electric living."

Cookers

The current trend of cooker design referred to in our issue of last week is much in evidence with double ovens, thermostatically controlled hotplates, rotisserie spits and units suitable for built-in kitchens well to the fore. Notable among British manufacturers, are English Electric, with their plinth-type double oven set one above the other, together with Creda, who are exhibiting their "Constellation" cooker with twin ovens placed side by side. Cookers with the oven separated from the hob so that they can be placed anywhere in the kitchen are shown by both Creda and Tricity.

Rotisserie spits, added to eye-level grills in medium-price range cookers, are in vogue, and both Jackson and General Electric are showing these adaptions as additions to their most recent models.

Many cookers are being brought into the semi-luxury class but are selling at moderate prices. Among these are Tricity's "Marquis" and "Viscount" Mark III; GEC's "Supreme," "Superb" and "Treasure;" Jackson's "Highline;" Creda's "Mercury" and Belling's "Classic 60."

Canadian manufacturers, known for their high-priced luxury cookers, are exhibiting an extensive range of automatic cooking units, among them Moffat's "Fiesta" (E.T., 2 March, 1961), with the unusual feature of a sliding hob to reduce projection. This company are also showing double-oven cookers. Although stainless steel is not yet widely used in cooker manufacture, Enterprise Foundry have designed such a model which won an International Stainless Steel Design award last year. It has a large oven finished in mirror chrome and a stainless steel hob. Soaring high into the luxury range with an oven which utilises micro-waves for cooking are Thompson Tappan, who sell this model at over £400. A Swedish company, Elektrohelios, are showing their combined sink and cooker unit with a double sink and three hotplates set above an oven and storage cabinets to make a complete kitchen unit.

Refrigerators

The popularity of prepacked frozen foods has led refrigerator manufacturers to allocate more space in their units for storing these items and also to introduce British-designed home freezers. Here, again, competition runs high and more 'fridges are being made for use in limited confines; many makers are showing these in conjunction with their larger models. Among the deep-freeze exhibits is Kenwood's latest model, a 5 cu ft freezer which can be "twinned" with a new refrigerator by the same company.

Catering for the flat-dweller, Tricity are now displaying their refrigerator with wood veneer finish, which is not out of place in the living-room. This "Diner-cold" has now been supplemented by a smaller version. The same company are also showing two comparable models for the kitchen.

The 12 member companies of DoRDeC are exhibiting a wide and varied range of models from the capacious to the smaller in-built units.

Others in this field are LEC, whose latest contribution is designed for the home handyman for building into cabinets. The 'fridge cabinet is supplied and a separate compressor. Elektrohelios, of Sweden, with refrigerator and deep-freezer and HMV with their Polar Star range are also exhibiting. Canadians, too, are showing deep-freezers and refrigerators, among them Beatty Bros and Gilson with their "Snowbird," and a model incorporating automatic defrosting, the "Defrost-o-Matic."

Washing Machines

A step ahead of other manufacturers with their fully automated "Keymatic," Hoover lead the washing machine market, where combined washers and spin-dryers are becoming prevalent. The "Keymatic" gives dual washing action by rotating drum and pulsator and correct temperature and time cycle for every kind of fabric, all controlled automatically by insertion of the appropriate key. Another newcomer is Creda's "Laundr-air," combination washing machine and spin-dryer, which competes with the improved "Hoovermatic." AEI-Hotpoint are showing their "Supermatic," "Countess," "Empress" and "Princess" models. Other combination washing machine-dryers which reflect the growing popularity of this type are being shown by Servis with their "Hi-zone;" Goblin's "Double G;" the "President" by Bylock; English Electric's "Liberator" and General Electric's "Double Plus." There are also Burco's "Twenty-one" twin tub washer shown with their "Tumblair" dryer, and models from the Electrical Division of Radiation. Commonwealth models are expensive but have not the features of the newest Hoover product.

Dish Washers

Intent on abolishing the washing-up chore, some manufacturers are producing dish-washing machines which are

effective but expensive. Models for wall mounting are competing with larger free-standing units such as the Dishlex Mobile and the familiar "Dishmaster" by Kenwood, although this firm also market a wall-mounted machine. The "Dishmaid" by Electrolux is another model which can stand on the sink draining board or be fixed to the wall. Others shown include "Swanmaid" by Bulpitt, and the familiar Colston model.

Fires and Heaters

Panel wall-heaters which give a greater degree of safety are shown by several companies, among them Dimplex, who also have a range of oil-filled heaters and towel rails. A Norwegian firm, Norvel, newcomers to this country, are showing panel heating units from medium size to as large as 10 ft long. They are also exhibiting a fan heater which can be regulated to three degrees of heat. Belling and Simplex both have a comprehensive range of radiators and convector heaters, and among the Ekco exhibits is a radiant-convector unit with automatic control. Imitation coal fires are still popular with Berry's "Magicoal" series, and a new European entry in this field is Stokvis, a Swedish company.

Vacuum Cleaners

Designed to fit in the living-room in the guise of a coffee table, a new cleaner from Bylock, the "Tablevac," sets a new trend. Ideal for use on one floor level, this cleaner has a movable tabletop under which is slung the suction cylinder encased in wood. The whole stands on castors and is easily convertible for either use. Hoover have introduced a new cleaner, the "Hooverette," which is styled in two shades of porcelain blue. With a view to hygiene, Goblin are now marketing a filter attachment for their cylinder cleaners. General Electric, Hotpoint and Electrolux are all showing their most recent vacuum cleaners, together with floor-polishers, which are also being shown by the other three manufacturers.

Lighting

A wide range of lighting fittings from the plain to the exotic and strip lights to chandeliers are on show, among them some Bohemian crystal wall brackets from Czechoslovakia. Thorn Electrical are exhibiting their "A" plan lighting and Vaclight their "Maria Theresa" chandeliers.

Ideal Homes

In a large variety of kitchen aids the growing popularity of the electric frypan is noticeable also the smaller food mixers. Several makes of electric blankets and hair dryers are being shown and for the home handyman there is a comprehensive selection of power tools.

NEW LITERATURE

Introduction to Modern Network Synthesis

by M. E. Van Valkenburg

AMERICA is currently responsible for a number of textbooks at undergraduate level on the subject of network synthesis, the applied mathematics of finding an LCR circuit that will have a specified effect on a signal traversing it. This latest addition is more concerned with the mathematics than most, which may make it more practically useful to engineers in the automatic control and telecommunications fields. It is clearly written and plentifully provided with examples for the student to work. Published by Chapman and Hall, 498 pages, 9 in. by 6 in. Price 94s.

Numerical Methods for High-speed Computers

by G. N. Lance,
M.SC., PH.D., M.I.A.S., A.F.R.AE.S.

THE applied field of computers, both digital and analogue, can broadly be divided into two parts; that for the solution of abstruse calculations of interest in the higher levels of scientific research and that for the day-to-day determination of practical quantitative analysis such as wage sheets, costing, etc. In each case the vital step for the operator is programming; that is preparing the form in which the figures are presented to the computer for calculation.

In this book the author, who is in charge of the Digital Computer Group at Winfrith, is concerned only with calculations in the first part and, therefore, writes for a limited readership. Moreover, it is evident from chapter two onwards that the reader must already be familiar with programming procedure and, preferably, be reasonably at home with such mathematical devices as Chebyshev polynomials, Christoffel numbers and the methods of Runge-Kutta, Jacobi, Lanczos and others. For the commercial user of computers the contents will almost certainly be incomprehensible. Published by Iliffe and Sons, 155 pages, 8½ in. by 5½ in. Price 42s.

Hi-Fi Amplifier Circuits

by E. Rodenhuis

A USEFUL and inexpensive book for the hi-fi enthusiast who is also an amateur radio fan and likes to build his own equipment. Opening with a brief survey of the basic factors affecting fidelity reproduction, the subsequent pages detail r.c. circuits for amplifiers from 3 W to 20 W output with the associated power packs. Pre-amplifier circuits are dealt with in the final chapters. Published by Cleaver Hume Press, 105 pages, 8 in. by 5¼ in. Price 15s.

Welding Handbook

Sect. 3. Special Welding Processes and Cutting

ed. by A. L. Phillips

THE American Welding Society's "Welding Handbook" is broken, for convenience, into five parts. The first two have already passed through four editions and the remainder through three. This, the fourth edition of section three, has been considerably extended to include welding by adhesive bonding, mainly an aircraft technique at present but rapidly extending to other fields; plastics welding, which embraces such specialised techniques as friction welding, hot air or gas welding, heated-tool welding, etc; as well as the even more recent developments of ultrasonic and cold welding of the non-ferrous metals. Other techniques discussed in this very comprehensive work encompass thermit, gas and arc welding, metallisation processes, brazing, cutting, gouging and allied developments, with a wealth of detail and information of interest to all who are concerned with jointing of metals and plastics. Published by Cleaver-Hume Press, 500 pages, 9 in. by 5¼ in. 78 tables, 139 line and 196 half-tone illustrations. Price 72s.

BOOKS RECEIVED

Problems in Electronics, with Solutions, by F. A. Benson. 302 problems with solutions stated at some length, covering undergraduate level courses. Published by E. and F. N. Spon, 249 pages, 8½ in. by 5½ in. Second edition. Price 42s.

Newnes Electrical Pocket Book, ed. by E. A. Reeves. Revised version of brief guide to power engineering equipment. Published by George Newnes Ltd., 392 pages, 6¼ in. by 3¾ in. Fifteenth edition. Price 10s 6d.

Electronic Maintainability, Vol. 3, ed. by F. L. Ankenbrandt. Collection of American articles on aspects of maintenance engineering, with special reference to electronic equipment. Published by Chapman and Hall, 312 pages, 9 in. by 5½ in. Price 80s.

Electromagnetic Fields and Waves, by R. V. Langmuir. Graduate level text-book centreing on Maxwell's equations and leading to telecommunication topics. Published by McGraw-Hill Publishing Co. Ltd., 227 pages, 9 in. by 5½ in. Price 76s.

Electrical Times, 9 March, 1961

Power for the Press

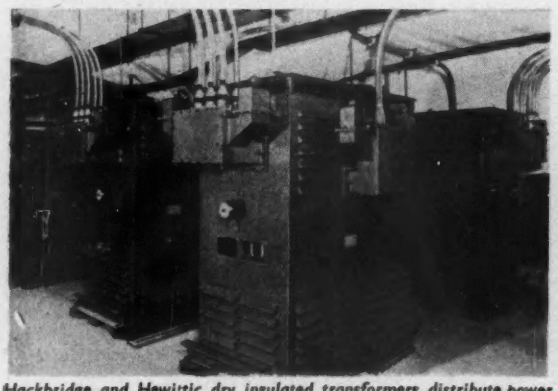
7,500 kW INSTALLATION FOR DAILY MIRROR BUILDING

COMBINING as it does the dual functions of a large newspaper printing works and associated editorial and administrative offices, the newly completed 11-storey *Daily Mirror* building presents a diverse electrical installation. Power demands are quite considerable and will eventually amount to a maximum of 7,500 kW when all five of the ultimately planned rotary press lines have been installed at fourth basement floor level. Two press lines are already installed and in operation and these have an aggregate rating of 2,900 h.p. Other electrical load is represented by motor drives for the lift installations, heating and air-conditioning systems, which together account for 3,000 h.p. To this must be added 1,320 kW consumed by immersion heaters in the print metal casting foundry. Finally, there is the electrical load contributed by conveyors, canteen kitchen equipment, lighting and telecommunications equipment.

Telecommunications and Lifts

An essential requirement of any newspaper office is an efficient means of communication with the outside world. In the case of the *Daily Mirror* building, besides the usual teleprinters, tape machines and picture transmitters, this is provided by the latest cordless-type private branch automatic telephone exchange supplied by Standard Telephones and Cables. The exchange caters for 800 extensions, 98 exchange lines and 13 private lines. Manual operation is by press-button keys, eliminating the need for switchboard cords.

Rapid mobility of staff is also important, particularly in a large multi-storey building. To this end, the lift service provided by the Otis Elevator installation is claimed to be one of the most efficient in the world. There are six high-speed passenger lifts with an additional one for the use of senior executives. These travel at 700 ft/min, enabling an ascent to the eleventh floor in under 15 sec.



Hackbridge and Hewittic dry insulated transformers distribute power in the "Daily Mirror" building

The lifts are fully automatic and controlled collectively according to a time-scheduling system designed to give the most efficient service possible under varying traffic conditions. There are, in addition, six heavy goods lifts also collectively controlled. In this instance, landing calls are answered in strict rotation unless the particular lift is fully loaded, in which case calls are by-passed until the lift is unloaded.

Ventilation

Heart of the building, and undoubtedly most impressive, are the rotary press lines. Each is 162 ft long, weighs 820 tons and is powered by 20 motor sets. Each motor set comprises a 72½ h.p. a.c. commutator motor, a two-speed barring motor, ventilating motor and brush setting motor for variable speed control. Ancillary equipment includes paper reel handling and auto-pasting machinery, and printed copy conveyors.

A major problem presented by such high-power machinery installed below ground level was that of ventilation. In order to cope with the heat dissipated by five press lines running simultaneously it has been necessary to install four ventilating plants. These provide 12 to 25 air changes/hour, equivalent to the movement of 360,000 cu ft/min. Extracted hot air is exhausted from the top of the building via 200 ft long ducts. The installation has been so designed that full air-conditioning can eventually be provided to cope with extra heat dissipated, should it be decided to add colour decks to the printing lines at some later date. Air-conditioning is already installed on certain of the office floors. Refrigeration compressors, fans, and other air-conditioning and ventilating plant are situated on the top floor of the building.

Distribution Transformers

To meet maximum load requirements of the building, there are two 11 kV LEB supply switch-rooms at first basement level, situated at diagonally opposite corners of the building. Each houses five-panel Reyrolle switchboard, having two incoming and two outgoing 0·25 sq in. cables, controlled by o.c.b's, and incorporating, respectively, Solkor and earth-leakage protection. The two outgoing cables feed into nine- and ten-panel switchboards, also by Reyrolle, these coming under the supervision of *Daily Mirror* engineering staff. The latter switchboards control between them 12 11,000/415 V, dry insulated, natural air-cooled transformers by Hackbridge and Hewittic, each rated at 1,000 kVA. These possess the advantage of being 40% lighter in weight than the equivalent oil-cooled type, in addition to being fireproof and giving greater flexibility of layout. The 415 V three-phase transformer outputs are fed to either air-break switchgear, controlling the press lines, or switch-fuse units connecting to the main l.v. distribution.

new products and appliances

New contactors

TWO new types of contactor recently announced have been developed from existing ranges by making certain modifications. In the case of the "Type BC," original insulation has been replaced by a glass-loaded compound, the moulding having recesses to carry the contact blades which are said to provide greater clearances and creepage paths to meet Services and international standards. For the "Type LC," the armature ball-bearing pivot has been replaced by stainless steel pin and brass bush. This type of bearing is claimed to be particularly suitable for normal rates of operation. For both units, fully tropicalised coils are insulated for 600 V d.c. or 250 V a.c. and are continuously rated. Typical contact ratings available are 15 A for silver and 5 A for tungsten, both at 440 V a.c. Plug-in versions of these contactors are available if required. *Londex Ltd., Anerley Wks, 207 Anerley Rd, S.E.20.*

Cheaper toaster

DESIGNED to attract by reason of its price, the most recent addition to the Morphy-Richards range of automatic toasters sells at £5 10s, including purchase-tax. With a loading of 1,000 W it has a thermostatically controlled browning range from pale to deep brown and the control lever is set at the base, moving horizontally across a graduated scale. Two slices can be inserted into the bread-carriage and the current is switched on by depressing the carriage-lever. Streamlined, this model, T O S, is 10¼ in. long by 5½ in. wide and 7½ in. high. It has a hinged crumb tray in the base which also acts as a heat guard. The model is finished in chrome and black. *Morphy-Richards (Cray) Ltd., 50 Conduit St, W.1.*

High-sensitivity photo-cells

A RANGE of high-sensitivity cadmium sulphide (or selenide) photoconductive cells is now available in this country. These are claimed to be some 20,000 times more responsive to changes in light intensity than earlier types of cell and to give output powers sufficient for the direct control of relays, solenoids and even small electric motors, without the aid of an amplifier. Types available have power dissipations ranging from 0·3 W to 2 W. Corresponding price range for these cells, which are relatively inexpensive, is from about 3s 9d to 49s 9d each, with discounts for large quantities. *Hird-Brown Ltd., 244 Marsland Rd, Sale, Ches.*

Scandinavian Refrigerators

FINNISH designed refrigerators are soon to be sold in this country under the brand name "Finnesse." Five models—two compressor and three absorption—range from 1·75 cu ft, at a retail price of 39 gn, to 4·4 cu ft, selling at 63 gn. The smallest model is designed for wall mounting, but can be placed on a table or stand on tubular-steel legs. It has an enamelled sheet-steel exterior. All five refrigerators have magnetically sealed doors and adjustable thermostats for temperature regulation. The two largest models have expandable polystyrene-plastics insulation, and retail at 63 gn and 61½ gn. *Finnsales Ltd., Colmore Row, Birmingham 2.*

Square-wave generator

RECENTLY put on the market, the "Type SW98 Square-wave Unit" is designed to provide driving signals for repetitive analogues. It will normally generate square-waves at mains frequency, but it can also generate in the frequency range 50 c/s to 10 kc/s from an external variable sinusoidal source, providing the peak input signal is not less than 2 V. Rise time is said to be about 2 microsec at any operating frequency and the output provided is variable, with a maximum of 50 V. *Servomex Controls Ltd., Crowborough, Sussex.*

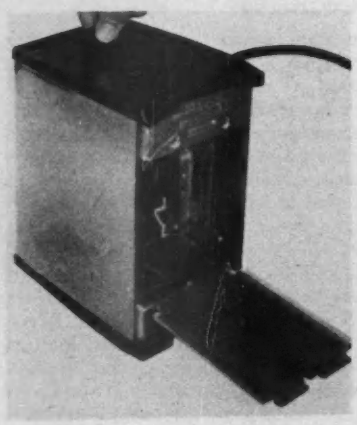
Metal-detector unit

FOR detecting the presence and position of metal objects, the "Proximitron" is a self-contained, transistorised unit having a wide range of industrial applications. These include counting, batching, drill breakage detection and checking possible omission of metal caps during bottling processes. Several types of sensing elements are available, such as loop coils or probes. The circuit used is said to be stable and unaffected by vibration and temperature variation. *MEC-TEST Ltd., Henrietta Hse, Henrietta Pl, W.1.*

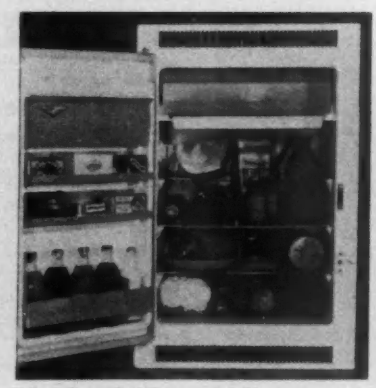
Roto-spit addition for "Highline" cooker

ADAPTING the eye-level grill on their "Highline" cooker with the addition of a rotisserie spit, Jacksons follow the trend of bringing their units within the semi-luxury range whilst retaining their space-saving advantages and moderate prices.

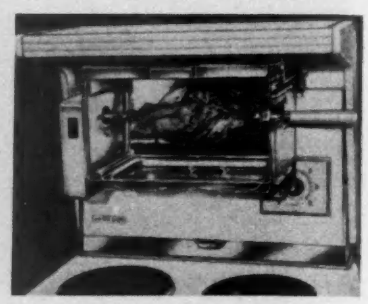
The rotisserie simply slides into the grooves already provided for the grill pan and can be fitted to existing models of the "Highline." It is driven by a small motor plugged into the kettle socket on the wall-mounted control panel. A removable glass front eliminates grease splashes on the hob and the spit skewer is adaptable for either prongs to hold broilers and joints or a double wire grid for steaks. The infra-red heat from the tubular grill element assists spit roasting and, although prototypes will be exhibited at the Ideal Home Exhibition, production models will not be available until mid-May when they will sell at £10. *Electrical Division, Radiation Ltd., 143 Sloane St, S.W.1.*



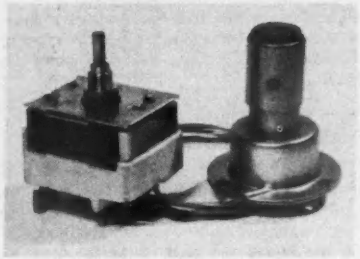
Morphy-Richards T O S automatic toaster costs £5 10s



4·4 cu ft model "Finnesse" refrigerator selling at 63 gns



Rotisserie spit incorporated in new Jackson "Highline" cooker



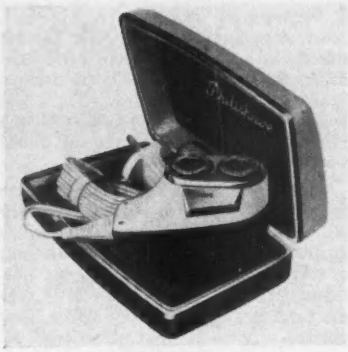
Teddington "Auto Chef" thermostat

Saucepan thermostat

A FEATURE of some of the latest domestic cookers on the market is the incorporation of a thermostat in conjunction with one of the radiant hotplates to maintain close saucepan temperature control. The English Electric plinth-type cooker (mentioned in last week's ELECTRICAL TIMES) uses the Teddington "Auto Chef." This has a spring-loaded sensing head, placed at the centre of the plate spiral element, which presses a liquid-filled phial up against the base of the pan. The phial is connected by a capillary tube to bellows contained in the control head. The bellows actuate two pairs of spindle-adjusted contacts which control both elements of a double- or duplex-wound spiral. When the temperature of the pan contents reaches a certain level, the first, or "anticipatory," pair of contacts open, switching-off one element. As soon as the final pre-set temperature is reached, the second element is switched-off and subsequently cycled on and off to maintain constant temperature. For single-spiral elements, only one pair of contacts is of course used. Bonus feature of the device is that it automatically switches-off the spiral elements if the saucepan is removed, since the phial is sensitive to the radiant heat from the uncovered elements which would have otherwise been absorbed by the pan. The "Auto Chef" has a maximum rating of 15 A at 110 V to 250 V and provides for a controlled temperature range of 180°F to 400°F. *Teddington Autocontrols Ltd., Windmill Rd, Sunbury-on-Thames.*

Bin level controller

NOW in full production is a control system for automatically emptying and filling bins, tanks, silos and other vessels used in industry and commerce. Heart of the system is the "Leveltron" control console, which is used in conjunction with ancillary equipment such as "high" and "low" level sensing units fitted to the bins, and motorised or solenoid valves. Such an arrangement can sample the levels of up to six bins in any desired sequence and ensure that levels are correct by opening or closing appropriate filling and emptying valves. The control console is dust and weather-proof and has dimensions of 5 ft by 2 ft by 1 ft 3 in. *Thomas Industrial Automation Ltd., Station Bldgs, Altrincham, Ches.*



New Philips shaver

Floating-action shaver

AFTER withdrawing the familiar Philishave Jet shavers last week, Philips introduce an innovation to electric shaving with a finely balanced razor head, similar in design to previous models, which is self-adjustable to the contours of the face. Universally jointed shaving heads are depressed at the slightest pressure—hence the floating action—two extra self-sharpening blades have been added to each head together with increased diameter of cutter guards combining to give 50% increase in total shaving area. The well-known rotary action is retained but a re-designed motor with dual voltage range is said to give double the power of previous models. Nylon gear wheels give smooth operation and need no oiling nor does the vibration-free motor which has bronze bearings.

Priced at 8 gn, including purchase tax, the manufacturers are making an introductory offer to retailers valid until 31 May. Wholesalers can give full credit on every dual or standard volt Philishave returned if dealers order two new models for every old one. *Philips Electrical Ltd., Shaftesbury Ave., W.C.2.*

IMPROVED INSTALLATION AIDS

CONTINUED improvements to mechanical aids and power tools available for general purpose factory and installation work is manifest in a new addition to the "Staffa" range of three-point bar-bending machines. This machine, actuated by a hand-pumped hydraulic ram, will handle pipes up to 1½ in. o.d. producing a 90° bend in 60 sec. Marks on the former casting give an indication of various angles of bend and the machine can be operated *in situ* without the need for a bench or stand. Other features claimed are robust construction and ease of operation and maintenance.

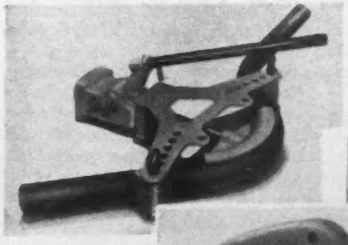
In the field of light industrial power tools, Black and Decker have extended their "Golden Key" range with the introduction of the "U40 De-Luxe Jig Saw." Among several special features incorporated in this model is the so-called "cycloid" action, the saw blade moving into the work-piece on the up-stroke and away from it on the return stroke. This is claimed to give a 25% increase in cutting speed for a given power input, longer blade life and to make it easier to guide the tool. Cutting capacity of the saw is ¾ in. thick hardwood and 1 in. thick softwood and it will also tackle 2 in. softwood at an intermittent rating. Other facilities offered are a variable angle shoe, automatic sawdust clearance and provision of a "rip fence" and circle cutting attachment. Price complete is £16 10s.

From another stable, Bridges have introduced two models of a heavy-duty version of the well-known "Neonic" ¼ in. power drill, one having a centre handle grip, the other a spade grip. Both models have identical performance and are said to deliver a high torque enabling a drilling capacity of ¼ in. diameter in steel and 1 in. diameter in hardwood. A double reduction gearbox is incorporated, giving a light running speed of 2,000 r.p.m. and 1,200 r.p.m. at full load. In addition to the "Neonic" eye safety feature, which will light up only if the drill is correctly wired and earthed, chuck guards are standard on both models. Having a basic price of £13 15s, the scope of these drills can be extended by means of accessories available, which include two-speed gearbox and shearing attachments and a drill stand.

Chamberlain Industries Ltd., Staffa Wks, Argall Ave, Leyton, E.10.

Black and Decker Ltd., Harmondsworth, Middx.

S. N. Bridges and Co. Ltd., York Rd, Battersea, S.W.11.

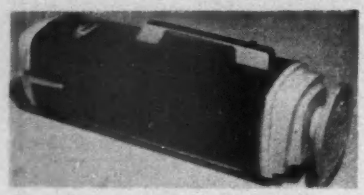


"Staffa" three-point bar bender ▲

Black and Decker De-Luxe Jig Saw ▶ alongside Bridges' heavy-duty "Neonic" drill, far right

Hygienic vacuum cleaning

IN an attempt to bring a greater degree of hygiene into vacuum cleaning the Goblin Co. have evolved a chemically impregnated filter which is fitted to the end of their newest range of cylindrical models. In previous cleaners the exhaust was discharged in an ever-increasing vortex so that minute germ-laden particles were returned to the room. This new addition, claim the manufacturers, filters all exhaust air through 12 layers of impregnated rayon fibre, giving a greater degree of cleanliness. The further addition of a synthetic rubber perforated cap on this "Filt-air" attachment ensures that the exhaust discharge leaves the machine in streams as opposed to the vortex and disperses into the air above floor level.



"Filt-air" attachment on new Goblin vacuum cleaner

Also on the three new models which the company are marketing in their Diamond Jubilee year is a deep-cleaning nozzle for carpets in which the brush can be adjusted to clean deep into the pile. They are the G. 72, G. 61 and G. 54. The first two have the "Filt-air" attachments supplied with the usual accessories, including the deep-cleaning carpet tool, and sell at 25 gn and 18 gn, respectively. A cheaper model selling at 14 gn has been adapted so that the "Filt-air" can be fitted as an additional extra at a price of 17s 6d, including tax.

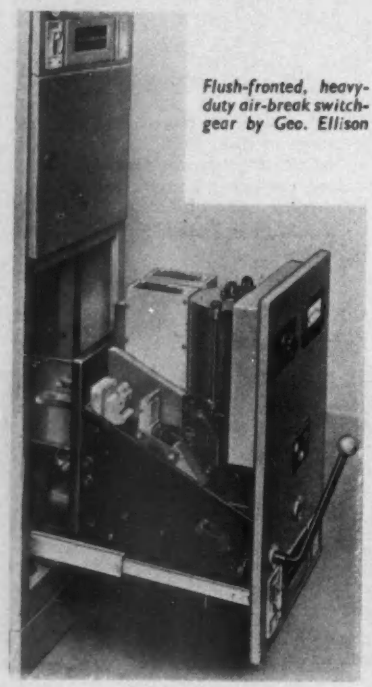
Refills for this new filter cost 1s each, three for 2s 6d, and the makers recommend they be changed every month. *Goblin (B.V.C.) Ltd., 97 New Bond St, W.1.*

NEW AIR-BREAK SWITCHGEAR

TO meet the need for flush-fronted switchgear where space is limited and heavy-duty conditions prevail, George Ellison Ltd. have introduced a new range of air-break switchgear for voltages up to 660 V, as we announced briefly last week.

Each unit in the series consists of flush-fronted sheet-steel cells in which are housed horizontally isolated double-tiered circuit-breakers or off-load isolators, and a central metering panel. The circuit breakers are available in 800 A ratings fully certified for ASTA No. 16 31 MVA rating and 26 MVA Class B rating, and a 1,600 A rating awaiting certification.

Closing of these breakers may be manual, spring-assisted, or solenoid-operated; opening is by push-button control. The operating mechanism is trip free and is designed for a light tripping load. Closure is carried out against high contact pressure. An anti-bounce device is incorporated to restrict arc restriking.



Flush-fronted, heavy-duty air-break switchgear by Geo. Ellison

In designing the main contacts of the breaker care has been taken to reduce the need for maintenance. Moving contacts each consist of two composite main and arcing contacts in parallel, connected by long flexibles to the lower moving contact. The flexibles move only about ⅜ in. during operation and so suffer little wear. Lower contacts are generally similar to the main contacts. Individually adjustable springs for fingers comprising the contact assembly provide self-alignment for contacts and permit accurate tensioning.

Ionised gases are effectively dispersed during circuit-breaker operation by detachable arc chutes having splitter plates. Efficient ducting to atmosphere is a feature of the design, reducing the back pressure across the main contacts.

Isolation of the breaker is carried out using the operating handle, which has to be moved, and inserted in a special aperture after depressing an interlock lever. Two withdrawn positions are provided, one for isolation with isolator terminals live but shielded, the other fully withdrawn, for maintenance purposes. Only four nuts need to be slackened to permit complete removal of the breaker mechanism.

Up to four solenoid-operated self-resetting automatic releases may be incorporated, located at the front of the circuit-breaker. They are c.t. operated and fitted with Ellison triple-action oil-dashpot time lags. Two sets of c.t.'s can be incorporated in each circuit-breaker.

George Ellison, Perry Barr, Birmingham 22B.

Small photo-flash bulbs

PHOTO-FLASH bulbs so small that five will fit into a matchbox are an addition to the AEI Lamp and Lighting Co.'s range. Claimed to be the smallest in the world the bulb is 1¼ in. long by ¼ in. diameter; they are suitable only for specially designed flashguns, two of which are available in this country at present. Zirconium foil and pressure filling combine to give extremely high light output for the size of bulb. The AG 1B has a light output of 4,000 lumen sec and the larger AG 1 7,000 lumen sec. The flash duration of both bulbs permits synchronisation with a wide range of cameras. The clear AG 1 bulbs are balanced for colour films and indoor shots on "Kodacolor" as well as monochrome films, and the blue-coated AG 1B is suitable for natural light colour films. *AEI Lamp and Lighting Co. Ltd., Melton Rd, Leicester.*

Trade-in offer

SUNBEAM Electric announce a £2 trade-in discount on many shavers. They have also introduced a scheme whereby they will take trade-in shavers of any make from the wholesaler, provided orders for either Shavemaster or Rollmaster razors on a one-for-one basis are placed. Usual discount will be allowed, plus £2, and 1s 6d for handling. *Sunbeam Electric Ltd., 14 Old Quebec St, W.1.*

Norwegian deep-freezers

A LEADING brand of Norwegian deep-freeze units, Isol, is entering the British market through a newly formed company, Strommen Engineering. The four models intended for domestic use have a cubic capacity range from 6·3 cu ft to as large as 20·6 cu ft and a price variation from £125 to as much as £245, both including tax. The deep-freezers are adjusted for automatic operation at temperatures between −4°F and −13°F and the thermostat is capable of adjustment for lower temperatures. Each partition in the cabinet has cooling elements and the units are equipped with hermetically sealed motor-compressors.

For the smaller household, the model H 180, a 6·3 cu ft freezer, which has one basket and two plastics nets for storage, is 34 in. wide by 23½ in. deep with a height of 39½ in. The largest model, H 585, is 69 in. wide by 31 in. deep and 39 in. high and has six storage baskets and a similar number of plastics nets.

The intermediary models, H. 335 and H. 460, have capacities of 12·3 cu ft and 16·2 cu ft and sell at £125 and £215, respectively.

The units are set on rollers to assist movement. *Strommen Engineering Ltd., Essex St, Strand, W.C.2.*

Study during P.G. training

FULL-TIME COURSE FOR ELECTRICAL ENGINEERS

THERE is general agreement that a three-year undergraduate study of engineering has to be followed by an apprenticeship. It is further widely held that, in modern conditions, some additional period of formal study is required by engineers. That, at least, is the starting point for an IEE paper* presented last week, which discussed the form which such post-graduate studies should take.

A particular engineer's need for post-graduate study will depend largely on the aspect of electrical engineering in which he is concerned. The paper restricts itself to the needs of men who will subsequently find employment in research, development or design.

The authors argue that, strictly speaking, the acquisition of useful information is not the purpose of the three-year undergraduate course. The first concern of the university must be to develop and train a man's mind, to inculcate habits of critical inquiry, careful observation and logical deduction, and to develop in him the ability to learn for himself. Acquisition of information will be incidental. Fundamentally, there is available a greater body of distilled knowledge valuable to engineers than can be contained in a three-year course.

The question also arises, since the graduate has been trained to learn, whether he may not be left to find out for himself what he subsequently needs to know. However, the authors argue that formal instruction is likely to be more efficient.

When to Study

If it is accepted that formal education should be provided, the question arises at what stage in the engineer's career should it come? On the whole, the authors reject the tidiness of making post-graduate study follow immediately after graduation. They consider that great educational advantages exist in deferring study for a period of about a year. One advantage of this is that it enables engineers to have time to make a choice about specialisation; another, that every year at that stage of an engineer's development brings a marked increase in maturity, increasing the value of further study.

Post-graduate courses, in the opinion of the authors, should be organised at universities, and should be open to the employees of all firms alike. This has obvious importance for smaller firms and their employees. Individual lecturers can be recruited from a wide field. Close co-operation between industry and university is important, covering personnel and finance.

The authors discuss in some detail how long post-graduate courses should last. The arguments are complex, but the general conclusion is that it should comprise a full-time period of about one term, during the second post-graduate apprenticeship year, with some part-time work in the earlier year. An uninterrupted period of study has been shown by experience to be preferable to a longer period on a one-day-a-week basis.

Content of post-graduate courses is the subject of the final section of the paper, where courses organised at Manchester College of Science and Technology are described. First-year courses are concerned with preparing the engineer for the intensive eight-week course during the second part of his apprenticeship. In this eight-week course, all students study matrix algebra, numerical analysis, digital computer techniques, and the analysis of observations. This common work is backed by one of four specialised courses. That in electrical machines, for example, includes the study of synchronous, induction and d.c. machines, matrix and tensor analysis, computers in machine design, field theory, and cooling. The course in power systems covers analysis of synchronous machines and systems, per-unit and co-ordinate systems, high-voltage transmission, and system protection and power system stability. There is appropriate laboratory work in each of the four specialised courses, which occupies about 30% of a student's time.

DISCUSSION

DR W. J. GIBBS (AEI) suggested that courses such as that described in the paper should come much later in a man's career, not during apprenticeships. They should be residential and held in long vacations. Also they should be more concentrated than the eight week duration suggested.

PROF E. BRADSHAW (Manchester College of Science and Technology) thought the course might be left later than the apprenticeship years. However, it was a fundamental problem, whether something was wrong with the educational pattern, if after three years at a university and two years apprenticeship it was still necessary to send people back for further training.

MR H. W. FRENCH (Ministry of Education) said that today in university or Dip.Tech. courses, little more was possible than the laying of a sound framework of electrical engineering education. Specialist training needed to be given later. The Russians had 5½ years courses in training their control engineers.

DR G. S. ATKINSON (Rugby College of Engineering Technology) agreed that for the university graduate there should be a gap between the end of his university course and beginning post-graduate courses. For the works-based Dip.Tech. student, this gap need not be so long.

PROF J. GREIG (King's College, London) thought there was a need for a course of a more fundamental character, a post-graduate course based on advanced mathematics and modern physics and the study of some branch of fundamental technology. Such a course should be carried out immediately after graduation.

PROF M. W. HUMPHREY DAVIES (Queen Mary College) asked that industry should classify graduates earlier in their employment, so that training could be more objective. MR D. P. SAYERS (CEGB) thought it wrong to tell a graduate that after three years at university, he still could not do his job.

There were several other speakers.

* Paper No. 3539: "The Place of Formal Study in the Post-Graduate Training of an Electrical Engineer," by N. N. Hancock, M.SC.TECH., A.M.I.E.E., and P. L. Taylor, M.A., A.M.I.E.E. Mr Hancock is at the Manchester College of Science and Technology and Mr Taylor is with AEI (Manchester) Ltd.

News of the Week

Sheffield approve 'fridge rentals

"Coldair" 3 cu ft. models at 2s 6d a week

SHEFFIELD Corporation is to go ahead with its 2s 6d a week rental plan for refrigerators for council house tenants. This was decided at the meeting of the City Council on Wednesday of last week, despite strong opposition from members. Adopting the Housing Management Committee's scheme, the Corporation will rent "Coldair" 3 cu ft models and it is estimated that 7,000 may be provided during the coming year. No contract for the refrigerators has yet been placed, but the Corporation is now making application to the Ministry of Housing and Local Government for loan sanction for about £240,000.

The refrigerators would cost £33 2s 6d each, plus £4 15s 3d installation cost. Depreciation allowance and service charge together amounted to £5 19s 2d a year, against a rental income of £6 10s, it was stated.

The scheme has been opposed from the outset by local retailers who have joined together in the Sheffield Electrical Traders' Protection Association, as we reported on 26 Jan. When the Association earlier suggested that the Ministry of Housing should not approve the plan, they were told that as loan sanction had not been applied for at that time he could not give a decision. Now the Association are to repeat their request and, if unsuccessful, may make representations to the Chancellor of the Exchequer.

They argue that the Council's rental scheme circumvents the credit squeeze by making the refrigerators part of the fittings of the houses. It could also be the forerunner of other rental schemes.

HIGHER CONSUMPTION WITH WET WEATHER

THE wet, miserable weather of last autumn must have played a contributory part in the remarkable increase of 22½% in unit sales in the three months ended 30 Dec. last. Farm consumption, at 33·7% up, may also reflect an increased use of crop dryers. Whatever the cause, these latest quarterly classified figures of unit sales, just issued by the Electricity Council, will provide much food for thought and act as a background to earlier fears of possible load-shedding trouble. The percentage increase of the industrial load, 8·2%, was well below that of the previous three months. It must be remembered that the figures given in the accompanying table cover England and Wales only, and refer to units metered or billed during the period concerned.

	3 months ended		12 months ended	
	31 Dec. 1960	% gain over last year	31 Dec. 1960	% gain over last year
Domestic ...	7,275·1	+22·5	30,107·6	+15·8
Farm	444·8	+33·7	1,724·9	+15·3
Commercial ...	2,993·3	+18·4	11,628·4	+13·5
Combined dom/comm.	367·4	+18·5	1,523·8	+13·6
Industrial ...	12,337·3	+ 8·2	46,283·2	+12·0
Public lighting...	244·4	+ 8·7	771·2	+ 8·3
Traction ...	407·5	+ 1·9	1,569·3	+ 2·6
Total (millions)	24,069·8	+13·8	93,608·3	+13·3

MOBILE POWER PLANT

THE development of a mobile version of its 3 MW gas turbine generator plant (as already in service by the South Western Electricity Board), has now been announced by Bristol Siddeley Engines Ltd. The whole equipment can be loaded on a standard road transporter, with control pack in a trailer, or on a railway flat car. Its small size and relatively light weight (maximum weight of the 34 ft long generator pack is 44,400 lb), are claimed to make it easily transportable by sea or air. The control pack is 17 ft long.

Y.E.B. raise Tariffs

TARIFF increases, to operate from 1 April, are announced this week by the Yorkshire Electricity Board. In the domestic block tariff the secondary rate is raised by ¼d to 1¼d, and the running charge from 0·8d to 0·9d. Similar increases apply to the commercial rate, where the intermediate charge of 2d becomes 2¼d. In addition an extra unit per room is to be charged at the primary rate.

There is an increase of 5s per kVA (or kW) p.a., or 6d per kVA per month in the two-part tariffs, where the unit charges are raised by 0·65d in the first block, 0·55d in the second block and 0·35d in the third block. The latter increase also applies to one of the off-peak tariffs.

It will be noted that even at 0·9d p.u., the YEB's domestic rate is still the lowest in the country. Explaining the need for the increases, the Board say a realistic assessment of the position must take account of additional costs totalling £3½ million per annum, excluding additional coal costs recovered from larger consumers.

Sizewell line approved

AN amended route for the proposed supergrid line from Sizewell nuclear power station to a new substation at Bullen Wood, Bramford, was approved by East Suffolk County Council at its meeting last week. The amended route will run from Sizewell, south of Leiston, north of Campsea Ash, south of Wickham Market and Pettistree, north of Grundisburgh, south of Witnesham and north of Whitton, Ipswich, to Bramford.

Aircraft Power Laboratory nears Completion

A NEW building at Eastern Avenue, Romford, for the Plessey Co. Ltd., now nearing completion, is to be used as a laboratory to test and develop aircraft generation systems. The initial installation will be capable of handling four paralleled channels of equipment up to 120 kVA normal load per channel with complete simulation of environmental conditions likely to be met by aircraft of the next decade. The generator drives have a speed range in excess of 3:1 with controlled acceleration up to 1,200 r.p.m./sec and a capacity of 200 h.p./drive. Three-phase loading, both resistive and reactive, will be variable between zero and 150 kVA/channel. Adequate cooling facilities are being installed to enable simulation of supersonic flight conditions.

Automatic testing of electronic control equipment will enable years of flight experience to be obtained in a few hundred hours to ensure that fully proved systems are available to the industry from the commencement of a project, which should avoid some teething troubles.

First to be proved in the laboratory will be a four generator system of 160 kVA capacity to be used in the Vickers VC10 aircraft. This equipment is being manufactured under licence from the Westinghouse Electric Corporation of America.

To provide the necessary power for drives, cooling equipment, etc., the Eastern Electricity Board are installing within the building a 1·5 MVA substation.

G.E.C.—R. & A. (Holdings) Merger

THE plan for the takeover of Radio and Allied (Holdings) Ltd. by the General Electric Co. Ltd., to which we briefly referred last week, seems to be proceeding without hitch. It will, in effect, be a mutual amalgamation of the respective interests and development plans in the radio, television and domestic equipment fields. It is now known that R and A (Holdings)—the "Sobell" and "McMichael" radio and TV firm—were considering entering the domestic appliance market in view of the virtual stagnation of their other activities and Mr Charles F. Richards (formerly of Morphy-Richards) was involved in those negotiations. In the new combined undertaking Mr Richards is to be joint managing director (as we note on page 370) along with Mr A. Weinstock (of R and A), with Mr M. Sobell, chairman of the latter concern, also joining the GEC board.

In the financial details of the acquisition, holders of 5s Ordinary shares in R and A will get one GEC £1 share plus 2s cash, and for every 6% Cumulative Preference £1 R and A share, 20s cash.

With the capitalisation of £36,750 standing to the credit of the convertible share reserve account the issued share capital of R and A consists of 292,500 6% Cumulative Preference £1 shares, 1,800,000 Ordinary 5s shares and 3,200,000 convertible Ordinary 5s shares.

It is anticipated that the profits of both GEC and R and A for the years ending 31 March and 30 April, respectively, will be lower than for the previous year. But the GEC board intend to maintain a 10% dividend for the year and upon the merger becoming effective, will, in order to simplify merger arrangements, declare in lieu of the final dividend normally payable in September, a second interim of 7%, payable on 1 June.

On the part of R and A the board is to maintain the Ordinary shareholders' income during the transitional period by making a final dividend for the year to 30 April, a second interim of 22½%.

CANTERBURY-LYDD LINE CLEARED

THE Minister of Power has ruled out farmer Merrick's objection to the erection of a pylon on his land at Newchurch, which officially clears the overhead route of the 275 kV line between Canterbury and Lydd. Farmer Merrick had refused permission for the erection of one pylon on his land—thus holding up completion of the line—and the Ministry held an inquiry last October. He maintained that the line would be a potential danger to his farm workers and would interfere with overhead irrigation and aerial crop spraying. The Minister considered that these objections would be equally applicable no matter where the lines were placed. He sympathised with Mr Merrick's view, however, that modern developments in farming could influence the amount of compensation payable and he saw no objection to the incorporation of special conditions sought by Mr Merrick. One of these was that the minimum clearance of the lines above ground level should be 32 ft.

COOKER INQUIRY IN EIRE

A PUBLIC inquiry into certain aspects of the supply and distribution of cookers and ranges (including electric, gas and solid fuel) is to be held by Eire's Fair Trade Commission. The inquiry concerns resale price maintenance. Entry to trade in these goods will be considered in so far as that aspect of trading is affected by any arrangements for the maintenance of prices. Submissions on the matter, which have been invited from interested parties, are to be lodged by 25 March.

This will be the first public inquiry to be held under Eire's Restrictive Trade Practices (Amendment) Act, 1959.

Takeover News

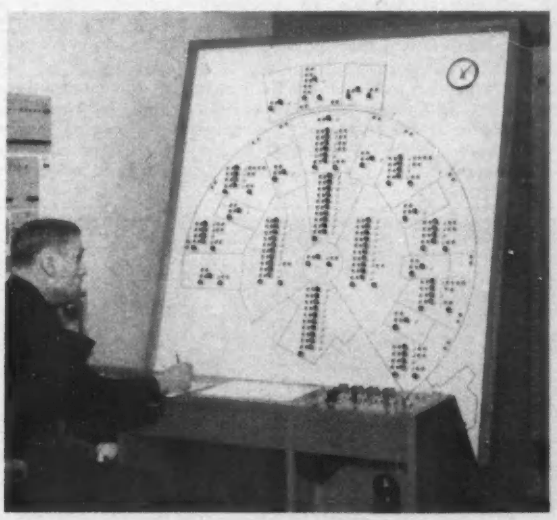
THE 51% interest in John E. Dallas and Sons, radio and musical instrument manufacturers, acquired by Keith Prowse and Co. just over two years ago, has now been sold to Mr Gordon S. Lee, chairman and managing director of Lee Products (Gt. Britain) Ltd., for around £80,000—giving Keith Prowse a small profit on book value, it is stated. In August, 1959, Lee Products acquired the Dulci radio business.

THE complete takeover of the English Telephone Co. by E. Shipton and Co. (Holdings) Ltd. has now been agreed in principle, Sir Leslie Nicholls, chairman of Shipton's announced last week. The latter company is to purchase the share capital for an amount (not exceeding £50,000) to be determined. It is also to buy all existing installations of the English Telephone Co., together with the benefit of rental agreements, for around £110,000, plus a further sum for installations completed by 30 June next. The possibility of a merger of the two concerns has been under consideration for some time.

TV Centre's Fire Warning System

COMPLETION is reported of an extensive fire alarm installation by Standard Telephones and Cables for the BBC's Television Centre at the White City in London. Nerve centre of the system is the fire control room where the duty fireman has at his disposal a four-key cordless, telephone switchboard, connected to the Centre's private automatic branch exchange. There is also an indicator panel displaying a sub-divided plan of the Centre on which floor positions of sprinkler, CO_2 and "temperature rise" alarms are pinpointed by indicator lamps. Fire calls to the control room are made by dialling 666; should one come through, a buzzer sounds and the floor location of the caller is indicated by a flashing lamp on the panel.

If a fire is reported to the duty fireman, he can switch on alarm bells for the floor, or floors, affected and immediately alert by telephone all patrol firemen in the Centre. For this purpose there are "fire" telephones placed at strategic points on patrol routes, incoming calls to individual telephones being registered by a flashing light. Any fire outbreak which takes hold before it is spotted will soon be made known by a lamp lighting up on the indicator panel due to the operation of the temperature rise alarm, automatic sprinkler or CO_2 systems.



This fire alarm indicator board, at BBC's Television Centre, comprises a combined site plan, a four-key cordless telephone switchboard, and a "missing key" hydrant alarm panel.

CONSULTATIVE COUNCILS VALUABLE

SAFEGUARDING the interests of consumers was nowhere more highly developed than in the electricity supply industry, Lord Citrine told the East Midlands Electricity Consultative Council last week. Consultative councils had been in existence for nearly 13 years and Lord Citrine said that "he was happy to think that while maintaining their complete independence they had afforded most valuable assistance to the boards."

Commenting on dissatisfaction with the prospect of electricity prices being raised, he remarked that during the latter part of 1960, electricity boards had found themselves faced with increases in wages, salaries and the price of coal, together costing the supply industry about £22 million in a full year. Such additional costs could not be absorbed without increases in charges.

Also speaking to the ECC was Mr O. S. Woods, Divisional Controller of the East Midlands Division, CEGB. He said that nearly 40% of the 2,000 MW new generating plant installed in 1960 had come into operation in the East Midlands Division.

It was cheaper to transmit electrical energy over 50 miles rather than take coal to power stations local to the load.

On the question of transmission development, he said that reinsulation of the 275 kV line to 400 kV would increase power capacity by 60%. There was no substantial economy then to be gained by operating at 400 kV, but it would be possible to have fewer lines than otherwise.

When he came to comparative costs for overhead lines and underground cables, Mr Woods quoted the following figures for double circuit overhead lines and their equivalent for underground cables.

	Overhead Line	Cables	Multiple
132 kV	£14,000	£100,000	7
275 kV	£24,000	£400,000	16
*400 kV	£40,000	£550,000	14

* Estimated

As an approximation, the total annual capital expenditure by the CEGB would be double if the transmission system were entirely by underground cables.

Eire steps up expansion

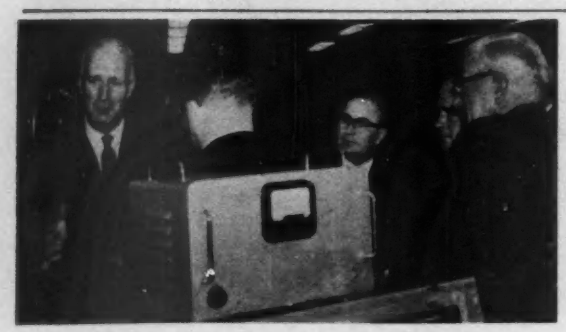
WITH an increasing power demand Eire has decided to expedite its new generating plant programme. In January, 1960, the Minister for Transport approved the Electricity Supply Board's programme aimed at meeting a 7% growth in demand between 1964 and 1969. But in view of increasing industrialisation, the Board have revised that estimated increase to 10%.

The Minister has now approved an ESB plan to expedite new construction, to provide for commissioning in the years 1963 to 1967 of 280 MW of the 340 MW total of new plant planned for up to 1969. The revised programme also provides extension of the existing Allenwood peat-fired power station.

Oil-fired stations will continue to be sandwiched between peat-fired stations to ensure maintenance of electricity supplies in a year in which weather is very adverse for either turf or water generation of electricity or both. The programme does not rule out the possibility of additional capacity in the Arigna area if the results of present investigations into the utilisation of Arigna coal warrant it.

TECHNICAL TALKS ON TAPE

VISITORS to the Mullard exhibition of transistors, currently being staged at Torrington Pl, W.C.1, have had aspects of semiconductor manufacture, life-testing and design applications explained to them by a series of recorded ten-minute lectures illustrated with projected film strips. These have been recorded on one track of a twin-track magnetic tape. The second track carries recorded pulses which initiate the showing of film strip in any pre-determined sequence to fit in with the commentary. Mullard hope to make such recorded lectures available on loan to interested organisations, and also to extend the existing range of subjects.



Sir Christopher Hinton, chairman, CEGB, during his visit to the Erith works of British Insulated Callender's Cables Ltd. last Friday. The factory is the headquarters of the BICC Group Power Cables Division

MATERIALS FOR HOSPITAL BUILDING

MATERIALS and equipment in use in the building of hospitals feature in a temporary exhibition organised at the Building Centre, 26 Store St, W.C.1, which opens tomorrow. Aim of the exhibition is to show currently used material and equipment of good design and manufacture suitable for hospital needs. Illustrated are typical examples of a combined consulting-examination room for an out-patient department, a four-bed ward and a student nurse's bed-sitting room.

OFFICIAL PUBLICATIONS

Technical Education in Wales. HMSO. 7s (see page 388).

Diploma in Technology; Memorandum on Awards Conferred. NCTA.

Cost Engineering Studies

GOOD progress is reported by the British Group formed last year from members of the American Association of Cost Engineers. The Association has the object of providing facilities for cost engineers to meet, with the object of furthering application of scientific principles and techniques to problems of cost estimation, cost control, and profitability. Technical committees have been set up dealing with terminology, cost control, cost estimation and cost indices.

It is proposed to change the group's status in the near future to an independent (British) association of cost engineers with full affiliation and interchangeability of data with the pioneer body in the USA.

Czech Appliances for U.K.

THE UK is to import domestic electrical appliances from Czechoslovakia up to a total value of £32,000 during 1961 under a new trade agreement. Other items covered, and the allocation value, are portable power tools (£3,000); lighting glass (£150,000); and valves and components for radio receivers and TV sets; electronic microscopes, to a value of £60,000, of which not more than £12,000 is to be for transistors.

Among the goods which Czechoslovakia will import from the UK and their values, are: electric shaving machines (£10,000); domestic electrical appliances (£10,000); insulating materials, including thermal insulation and mica products (£20,000); laboratory instruments and measuring and testing instruments for different purposes (£150,000); electronic and communication equipment including cable, radio and TV receivers, sound reproducing equipment, valves and components (£50,000); and carbon, carbon brushes and electrodes (£40,000). In addition, Czechoslovakia will take £950,000 worth of other machinery, including electrical plant.

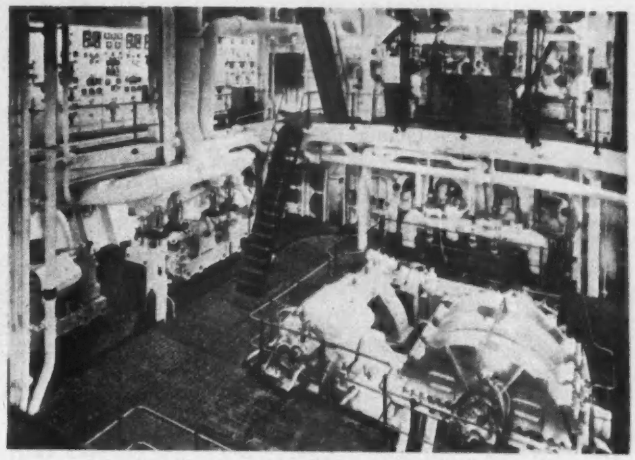
24½ acre substation site

THE CEGB have been granted outline permission for the establishment of a new substation on 24½ acres of land adjacent to Broadway La, Lovedean. But Hampshire Planning Committee have also referred the application to the Minister of Housing to enable an agricultural objection to be determined. The chairman, Brig Sir Richard Calthorpe, said the commitee did not approve of a substation of this size being placed in a rural area but there was no other suitable site. Part of the £3 million Portsmouth reinforcement scheme, to which we referred on 15 Dec., the 275 kV substation is planned to operate at 400 kV at a later stage.

Trossachs Line Proposed

APPLICATION for consent to the erection of a 275 kV transmission line in the Trossachs has now been made to the Secretary of State for Scotland by the North of Scotland Hydro-Electric Board. The lines are intended to transmit power from the Cruachan station to the grid system at Windyhill.

When the scheme was put forward last August, Glasgow Corporation objected to the route because of the effect it might have on amenities of the Loch Katrine area, where they own 23,000 acres of land. The Corporation suggested a route by the upper end of Loch Lomond and east of Ben Lomond. Since then two minor amendments have been made to the route, but it remains substantially the same, passing over Glen Gyle at the western end of Loch Katrine.



Over 4,000 hours trouble-free running—equivalent to six months' continuous operation—by a 425 kW AEI brushless alternator is reported by Shell Tankers Ltd. The tanker concerned is the 33,000 ton *Varicella* whose engine-room is seen here. Maintenance of the alternator has been negligible and automatic voltage control has been used at all times

Appliance deliveries down for Oct.-Dec.

THE last quarter of 1960 was a particularly unhappy one for manufacturers of the major domestic electrical appliances and the latest figures of deliveries covering that period, just issued by BEAMA, show just how badly the industry suffered. The trouble, of course, was the sudden sharp reversal from earlier steady increases following the April credit restrictions. The large reductions in deliveries were in respect of washing machines (61% down) and refrigerators (53% down), and although the output of combination washing machine/spin dryers rose by 16%, compared with the same period of the previous year, this was more than offset by the big reduction for those with hand or powered wringers. But deliveries of cookers of all sizes increased still further, along with space heaters, electric blankets and immersion heaters. Spin dryers, however, continue in the doldrums with reductions of 44% in deliveries at home, and of 19% for export markets.

The export side, however, had some bright aspects. Export deliveries of washing machines, amounting to nearly £2·3 million are a very welcome sign, and the combination type, which accounted for £1·6 million of that total, show a rise of 80% against a year ago.

Other items to show particularly good export increases are vacuum cleaners (38%), refrigerators (43%) and food mixers (39%), while dry shaver exports rose by no less than 323%.

Jan. 'fridge deliveries down

MANUFACTURERS' deliveries of domestic refrigerators to the home market in January totalled 43,144—46½% down on January, 1960, when deliveries reached 80,685—so the h.p. change halfway through the month has had little effect yet. Refrigerator exports for the month increased by 58·6% to 10,870.

MANUFACTURERS' DELIVERIES OF DOMESTIC ELECTRICAL APPLIANCES FOR OCTOBER-DECEMBER, 1960

	Home			Export			Total		
		Value			Value			Value	
	Number 000s	£000's	% change on 4th quarter of 1960	Number 000s	£000's	% change on 4th quarter of 1960	Number 000s	£000's	% change on 4th quarter of 1960
Domestic Laundering Equipment									
Washing machines with electrically driven means of agitation:									
(a) those with hand or power wringers	62	2,239	− 61	24·3	644·8	+ 22	86	2,884	− 54
(b) those combined with a spin dryer	114	7,039	+ 16	51·2	1,609·3	+ 80	165	8,648	+ 24
Wash boilers (up to 10 gallons)	53	356	− 19	0·9	6·5	+ 28	54	363	− 18
Spin dryers	65	931	− 44	10·6	136·2	− 19	76	1,067	− 42
Heated tumbler dryers	14	424	− 6	0·4	10·2	− 63	14	434	− 9
Irons: (a) non-automatic	40	27	− 23	13·7	8·1	+ 16	54	35	− 17
(b) automatic	436	757	− 14	193·7	293·4	+ 11	630	1,050	nil
Domestic Cleaning and Polishing Equipment									
Vacuum cleaners	242	3,282	− 33	77·3	626·7	+ 38	319	3,909	− 27
Floor polishers and scrubbers	6·2	83	− 8	17·0	146·4	− 9	23	229	− 9
Refrigerators									
Domestic electric refrigerators	59	n.a.	− 53	22·1	n.a.	+ 43	81	n.a.	− 42
Domestic Cooking and Kitchen Equipment									
Cookers: (a) below 5 kW	32	389	+ 39	1·9	16·2	+ 27	34	405	+ 38
(b) 5 kW to 12 kW	144	5,137	+ 11	4·1	113·4	− 9	148	5,250	+ 11
Food and drink mixers up to 3 quarts capacity, including all hand held	45	499	nil	23·8	304·7	+ 39	69	804	+ 12
Toasters	54	165	− 8	25·4	79·1	+ 10	79	244	− 3
Domestic Water Heating Equipment									
Immersion up to 3 kW	176	251	+ 29	3·0	6·1	− 47	179	257	+ 24
Storage up to 30 gallons	46	491	+ 29	3·7	51·3	+ 4	50	542	+ 26
Domestic Space Heaters									
All types up to 3 kW	1,192	4,704	+ 35	31·3	98·8	+ 7	1,223	4,803	+ 34
Personal Appliances									
Electric blankets	521	1,490	+ 30	2·3	5·3	+ 26	523	1,495	+ 30
Hand hair dryers	196	355	− 12	21·5	37·7	+ 91	218	393	− 7
Dry shavers	404	1,379	− 26	107·2	242·0	+323	511	1,621	− 16

INSULATING FILM FACTORY OPENED

MELINEX polyester film, which has many electrical applications, is being manufactured in a new Imperial Chemical Industries' plant, formally opened at Dumfries, Scotland, last week. Capacity of the plant is at least 2,000 tons/year of the film, which is made from Terylene polymer.

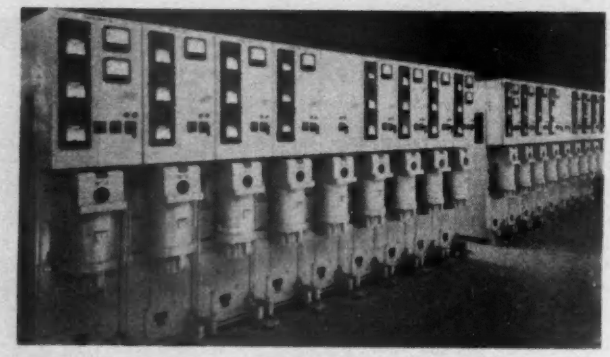
For the electrical industry, advantages of Melinex include high dielectric strength and availability in very thin gauges. This makes it promising for capacitors, motor slot insulation and as a barrier against water or plasticisers in cables. Up to the present, the material has been made on a pilot plant at Welwyn Garden City, but this has permitted little more than market evaluation because of limited output.

Cumbernauld Reinforcement

IN anticipation of a five-fold increase in the electrical load in the next six years, as the result of building development by the Cumbernauld Development Corporation, the South of Scotland Electricity Board has drawn up reinforcement schemes. The 33 kV Bonnybridge-Greenhill overhead line is to be extended to a new 33/11 kV substation which will be established in the town at Kildrum. Work on the scheme which will cost £118,000, will be completed during 1962. Of the 20,000 houses to be built by the Development Corporation, approximately 50% will have electric floor-warming. By 1966 it is estimated that the electrical load in schools in the town will rise to 6,000 kW, and the industrial load to 13,000 kW.

AT LEIPZIG FAIR

OVER 200 British firms are represented at the Leipzig Spring Fair, which opened on Monday and continues until Tuesday of next week. This makes Britain the second most extensive exhibitor after West Germany. Electrical engineering is prominent amongst the displays, although France is approaching Britain's figure.



Manufactured by Electric Switchgear (1953) Ltd., of Montreal, an associate of South Wales Switchgear Ltd., this 100 MVA 2,300 V 3-ph. switchgear was designed for the National Harbours Board, Montreal

EDUCATION REPORT FROM WALES

TECHNICAL education in Wales is now "more than adequate," says a report by the Central Advisory Council for Education (Wales), published last week. However, the Council added that support from industry for sandwich and other advanced courses "has been very disappointing." The Council had been asked to consider what educational provisions should be made in Wales.

The Council in their report called for establishment of a national craft apprenticeship system which would free individual industries from the responsibility for providing craft training.

Amongst other recommendations are that advanced technical courses should be restricted to five technical colleges and that these should be administered by a new Administrative Council. It also suggested that there should be greater co-operation between the Welsh College of Advanced Technology and industry and other technical colleges to ensure better support for the advanced technological courses offered by the college. The principle of releasing apprentices with pay to attend technical courses throughout their apprenticeships should be followed more widely by employers.

The five colleges suggested for advance work are the Glamorgan College of Technology; Newport and Monmouthshire College of Technology; Swansea Technical College; Denbighshire Technical College and the Welsh College of Advanced Technology, Cardiff.

TOXIC SUBSTANCES IN FACTORIES

CHANGES in the maximum permissible concentrations of toxic substances in factory atmospheres are published as an amendment to the list that appears in "Toxic Substances in Factory Atmospheres," a booklet issued by the Ministry of Labour last year. Copies of the amendment are being sent to all who bought the booklet and notified their desire to receive amendments. Figures of maximum permissible concentration given in the booklet are based on American work.

Retail Sales Up

RETAIL sales in January were 1% higher than a year earlier, BoT figures show, but sales by independent radio and electrical shops were down 9%. The nation's h.p. debt was £3 million lower at the end of the month.

Production and Orders Rising

A 4% increase in volume of production by the engineering and electrical goods industries for the fourth quarter, compared with a year earlier, is reported by the Board of Trade on the basis of returns. But this increase in production during 1960 was substantially less than the 10% rise during 1959, mainly because output of consumer goods expanded rapidly in the first nine months of 1959 and then dropped sharply half way through 1960. Output of capital goods has been steadily rising since the middle of 1959.

Exports of the engineering and electrical industries in 1960 were 8% up on 1959. The flow of new orders to those industries also continued on the upgrade, but deliveries kept pace with the rise, with the result that the volume of orders on hand, which had increased 16% during 1960, was no longer rising at the end of December, the Board of Trade estimates.

A level of 35 lumens/sq ft is provided throughout the offices at B.E.A.'s new five-storey building at London Airport. In all, over a thousand AEI 5 ft and 4 ft fluorescent fittings have been installed. This view is of a drawing office on the third floor, which has four rows of 20 fittings. Electrical contractors were Rashleigh Phipps & Co., Ltd.

STEELWORKS POWER PLANT EXTENSION

THE Mitchell Construction Co. Ltd. have been awarded a contract worth about £150,000 for the construction of an extension to the Workington Iron and Steel Co. (branch of The United Steel Cos. Ltd.) power station at Workington, Cumberland. The contract covers the construction of a steel-framed brick power station on a bored piled foundation, to house a turbo-alternator set together with ancillary buildings for transformers, switchgear, control room, etc. Parolle Electrical Plant Co. Ltd. are employed by Workington Iron and Steel Co. as engineering agents for the design and construction of the station extension and R. T. James and Partners have been appointed consulting engineers for the civil engineering works.

Electricity in "Which?"

REFRIGERATOR defrosting and electric-motored potato peeling figure in the March number of *Which?*, the Consumers' Association publication. The defroster dealt with is the automatic Defromatic unit, which can be used with existing refrigerators, providing a preset disconnected time every day to permit defrosting. It is considered satisfactory from the electrical operation aspect, but "unlikely to save electricity," and only likely to improve the performance of the refrigerator if it has previously been defrosted "very infrequently." The review attacks automatic defrosting by implication, for its effect on frozen foods stored in the freezer compartment.

In the course of a review of potato peelers, *Which?* alleges that the Moulinex electric-motor-driven model is "electrically unsatisfactory although not so bad as to be condemned as unsafe." It requires least effort for operation of all automatic potato peelers.

Tests on tape recorders published in the January number of *Which?* are being supplemented by two further tests. To be carried out after ageing, they will cover recorders' comparative ability to record music from radio or record player without microphone.

Sayings OF THE WEEK

"We may be able to persuade our consumers to install adequate wiring, but surely it must be on the basis of present needs rather than future possibilities." . . . MR R. B. RICHARDSON, of Eastern Electricity Board, at the EDA Conference.

"The conclusion we are forced to is that underground cabling cannot make an extensive difference to the growth of the electricity wirescape in the field of high voltage transmission." . . . SIR CHRISTOPHER HINTON, at the conference on Rubber and Plastics in Cables.

"The most serious chink in our intellectual armour in engineering is that engineering graduates are largely ignorant of modern physics." . . . PROFESSOR J. GREIG, King's College, London.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, March 7

	£ per ton	Weekly change £
COPPER, standard class A (settlement)	226½	−1½
" (3 months)	227½	+½
LEAD, refined pig, 99·97% purity (cash)	65½	+½
" (3 months)	66½	+1
TIN, refined, min. 99·75% purity (settlement)	804½	+3½
(3 months)	807½	+5
ALUMINIUM, ingots 99·99·5%	186	—
" wire bars (4×4×54")	193½	—
BRASS Strip 63/37	201½	—
SILVER (Troy oz)	79⅛d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	85½	+1
" (3 months)	83½	+½
RUBBER, per lb.		
No. 1, RSS, spot	25½d	+⅛d
c.i.f. basis, ports, May	25d	+⅛d
ARMOURING:		
Galv. Steel Wire (0·104 in.)	66½	—
Mild Steel Tape (0·04 in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	69	—
AMERICAN PRICES:		
Copper, electrolytic (per lb)	29c	—
Lead, (New York)	11c	—

* *Tape Price, now an average, includes varnishing*

F.B.I. RECONNOITRE NIGERIA

A UNIQUE industrial reconnaissance of Nigeria has recently been carried out by a delegation from the Federation of British Industries led by the director-general, Sir Norman Kipping. The delegation's findings have been published in a booklet, which sets out the industrial possibilities of this most recent member of the Commonwealth.

The main supply authority in the country is the statutory Electricity Corpn. of Nigeria and there are two other undertakings, the Nigerian Electricity Supply Corpn. in the northern region and the African Timber and Plywood Co. at Sapele.

Total units sold has increased from 77,000,000 eight years ago, to approximately 300,000,000 in 1960. Although this represents a consumption of only eight or nine units/year/head of population, growth of demand is rapid and schemes are in hand such as the Niger dam to provide adequate supply.

Already, two British firms, Joseph Lucas and Chloride Electrical Storage, have indicated their intention of putting forward proposals for the manufacture of lead batteries, but as yet no figures of employment or investment are available. Two other companies, BICC in collaboration with AEI, have under consideration the establishment of a factory to manufacture plastics-insulated cables and they propose an investment of £250,000.

Regarding the Niger dam, Sir Norman said that it was a project larger than the Kariba dam and, in all probability, the building of it would be open to world competition. He said it was difficult to assess the full potentiality of this construction as it would also include better irrigation and navigational facilities.

The delegation recommend that consideration should be given to three main points in the electrical field. Greater coverage of radio and television production; manufacture of air-conditioning units and installations which are widely used but expensive to run; and the proposition of a company manufacturing a range of lighting fittings using local woods.

M.C.T. CANDIDATES

TWENTY applications have been registered for study for the award of Member of the College of Technologists (M.T.C.), the higher award in the Dip. Tech. scheme. This was announced last week by the National Council for Technology Awards, when it also announced the names of those successful in recently completed courses for Dip. Tech. All in all, 450 Dip. Tech. diplomas have now been awarded and 4,969 students are studying for the diploma.

News in Brief

The Royal Assent was given to the Electricity (Amendment) Act last Thursday—it permits the CEGB to make and sell radio-isotopes.

The Southern Electricity Board is opening a new service centre at Portswood Rd, Southampton.

Two new 100 kW short-wave transmitters have been installed at the BBC's External Services transmitting station at Rampisham, Dorset. The first was put into operation this week.

The first of 500 McClary-Easy coin-operated laundries planned by General Steel Wares Ltd., of Canada, was opened in Walthamstow on Monday.

Mr J. T. Aitken has been elected president of the Birmingham Electrical Golfing Society.

Laying of a new transatlantic telephone cable from Scotland to Canada began on Monday.

The Yorkshire Electricity Board have reopened their modernised service centre at 26 King St, Thorne.

Complex Automation—Design for a Factory, by Mr J. F. Coales, will be the first paper at the Institution of Plant Engineers' conference at Blackpool from 19 to 21 April.

58,700 buyers visited the Cologne Fair —7% more than last year. BEAMA organised a discussion on the German market for British manufacturers on the spot.

Company Activities

BLUE skies and scarcely a cloud over Throgmorton St, the Stock Exchange certainly enjoyed a fine weather period of trading last week with most of the popular Ordinary share indices pushing ahead and some to new "highs" for the year. Wall Street continues to forge ahead and although Britain's gold reserves dropped by £18 million in February to £1,141 million, the first fall since January, 1960, there was the extremely cheering news that hire-purchase trading in the motor industry is now running at a higher level than at this time last year when there were no curbs on h.p. terms.

For the electrical share market it was a particularly notable week. Hoover created an extremely favourable impression with its three new products. Already trade orders have "flowed in magnificently" according to one of the Hoover directors, Mr H. Meads. At the end of 1960, furthermore, automatic machines of the "Keymatic" kind accounted for about 5% of all washing machine sales: hand and power wringer models accounted for about 45%. But by the end of 1968 Hoover estimate that the figures will be 56% for automatics and 15% to 10% for hand/power wringer machines. Twin-tub sales will drop from 50% of the market at the end of 1960 to an expected 25% by the end of 1968.

In terms of share price movements, earlier anticipation had already accounted for strong rises in both the Ordinary and "A" Ordinary shares, so that over the week the Ordinary closed slightly easier at 49s 9d and the "A" 4½d lower at 48s 6d.

At the "heavy" end of the market, Lord Nelson cheered with his full report on the affairs of English Electric. Their output in 1960 was practically identical with that for 1959 but order books in 1960 were substantially higher than ever before with the result that there are good prospects for an increased output in 1961. After so long in the doldrums the £1 Ordinary share moved breezily forward on this encouraging news from 33s 9d to 37s 9d. Lord Nelson also referred to the attempt to link with The General Electric Co. in order to rationalise over a broad front of the electrical industry. Although unsuccessful in the attempt he points out that rationalisation whether by means of merger, research agreements and other methods of making better use of the electrical industry's resources, both human and mechanical, is constantly under review.

Scarcely had these words appeared in print when GEC broadcast its £8½ million bid for Radio and Allied (Holdings), makers of the "Sobell" and "McMichael" TV and radio sets. The terms include one GEC £1 Ordinary share plus 2s in cash for each 5s Ordinary in R. and A. From 28s at the start of the week R. and A's shares moved swiftly up to 32s 6d, back to 31s 3d and then closed the week at 34s 3d. GEC, on the prospect of more shares coming on to the market, eased at one time to 30s 6d but finished the week's business at 33s. All eyes now turn to Ultra Electric, also makers of radio and TV sets, where takeover whispers have lifted the shares from 17s 7½d to 19s 2d.

Elsewhere in the electrical market, strong support for International Computers and Tabulators put the shares 7s 6d higher to 85s, Thorn Electrical tuned up from 52s 6d to 56s 6d, while, on US buying, EMI were lifted at one time to 48s 1½d before dropping back to close the week 3d easier at 46s 3d. AEI, in sympathy with English Electric, were wanted 2s 3d dearer at 44s 3d and Berry's Electric notched up another 2s to 45s 6d.

In first time dealings, Clifford and Snell, moved up to 2s 6d after being "placed" at 1s 6½d before closing the week at 2s 6½d—a somewhat buoyant sign.—*From our City Correspondent.*

Allied Insulators Ltd.

Trading profit, etc., for 1960 is £487,565 for this concern which was formed in 1959 with the amalgamation of Bullers Ltd. with Taylor Tunnicliff. Final dividend is 5%, making a total of 10% for the year, on capital doubled by a scrip issue.

Thomas Bolton and Sons

This copper and non-ferrous alloy firm increased its trading profit for 1960 to £448,067, compared with £286,690 in the previous year. In addition to the 7½% final dividend, again making a total of 10%, there is a 2½% bonus. Net profit after taxation, etc., is £195,388 (*£92,993*).

Cambridge Instrument Co. Ltd.

After increased taxation charge, the net profit for 1960 is £283,592, compared with £256,965 for the previous year. Dividend is raised from the equivalent of 20·41% to 22% on the increased capital with a final of 6%. The directors state that due to the short period between the date of merger with Electronic Instruments Ltd. and the end of the financial year of that company, the acquisition has had little effect on profits.

Electronic Rentals and General Holdings

The price of the one million 1s Ordinary shares to be issued on a one-for-six basis was fixed at 3s 3d each. Provision allotment letters went out earlier this week.

Ether Langham Thompson

The early part of the current year saw a slackening of commercial orders, but Mr F. B. Duncan, chairman, reports that the current trading position and the order book are good. Expansion of activities and new products being introduced should lead to increased turnover.

Hoover Ltd.

But for the policy of ploughing back large sums for development of its overseas subsidiaries and the expansion of export outlets throughout the world, the effect of the sharp contraction in home demand last year would have been even more serious, Mr H. W. Hoover, chairman, tells shareholders. In fact, the company claims to have been responsible for 75% of the UK's total exports of washing machines and vacuum cleaners in 1960, and over the past two years export trade has increased by nearly 61%. In view of the uncertainty of any linking of the EFTA with the Common Market, a comprehensive investigation is being undertaken by Hoover, SA, to explore the desirability of increasing productive capacity in the Common Market. At home, the new Cambuslang motor factory should be in operation next month, and consent for additional space at Perivale is awaited. Looking further ahead, a new concern, Hoover Worldwide Corporation, to which the company has contributed a 40% share, has been formed to study growing markets and act in an advisory capacity to the Hoover group in planning future policy and deployment of resources to the best advantage.

M. Mole and Sons

The order book is reasonable, but the recession in some of the trades to which the company supplies pressings, stampings and accessories may make it difficult to maintain production at an economic level this year, it is stated.

Relay Exchanges Ltd.

Group trading profit for the year ended 31 Dec. last increased to £3,949,892, from the previous year's total of £3,350,640. Dividend is also raised from the equivalent of 15½% to 20½% for the year, with a final of 12½%. Net profit is down to £1,023,556 (*£1,112,957*).

L. Sterne and Co. Ltd.

The fall in profits from £675,800 to £557,480 was due to difficulties experienced in the early part of the year at the Hermetic Unit Division and the Hillington cabinet factory. While the former has a very long order book, and Mr P. B. H. Brown, the chairman, considers the prospects are good, the factory output had to be reduced by short-time working.

Telegraph Condenser Co. Ltd.

With the group trading profit for 1960 dipping slightly to £720,398 compared with £773,222 for the previous year, the total distribution is reduced by 5/6% to 22½%, with a final of 12½% and a cash bonus of 5%.

OVERSEAS NEWS

from our correspondents abroad

CANADA

Grid Pays Its Way

Savings in the first year of operation of the Nova Scotia to New Brunswick grid are estimated at $5 million compared with the original cost of $7 million. During the summer drought, New Brunswick received power from Nova Scotia thermal plant and in the autumn, the power exchange was reversed. The grid has made possible deferment of the Tufts Cove power station possibly until 1966, when a much larger and more efficient station will probably be built.

Development Delay by BC

Two further lines of attack are being exploited by Premier Bennett in his opposition to the Government-favoured Columbia River scheme. Canada has only a limited time to develop the scheme under the Treaty. The BC Government is reputed to be more interested in development of the Peace Scheme by private interests and Premier Bennett is advocating export of power although this is forbidden by Federal Law. Recently he has turned his attack to estimates for the two schemes, although according to the Federal Justice Minister, he had previously raised no objection to them.

Water-starved Station

It seems unlikely that after the end of this year, with the new US Niagara plant in operation, sufficient water will be available to operate the Toronto Power Co.'s station which has been in service since 1906. Under the International Water Treaty, sufficient water is only likely to be available for the station during night time.

Steam Plant for Nuclear Station

Eight steam generating units each with ten heat exchangers are to be built for the 200 MW Douglas Point nuclear plant by MLW Services of Montreal. The contract, valued at $1 million, has been awarded by Atomic Energy of Canada Ltd. Completion is scheduled for mid-1963 and a prototype is to be built this year.

Shawinigan Generation Expansion

Additional power supplies required by Shawinigan by 1962 will be partially met by surplus power purchase from the Aluminium Co. of Canada, but a $20 million construction loan was recently mentioned. Projects envisaged are a hydro-electric development on St Maurice River and thermal plant construction on an undisclosed site.

S. AFRICA

First Home-built Train

Recently the first electric train to be manufactured in South Africa was completed by Union Carriage and Wagon. The train, consisting of an electric coach and six all-steel trailer coaches, is the first of a £9·5 million order for 56 units placed by South African Railways.

Swartkops Power Station Opening

The Swartkops power station at Port Elizabeth was officially opened recently by the Mayor when he energised the switchyard. An illustration of the switchyard, which cost £250,000, was given in ELECTRICAL TIMES for 16 Feb., 1961.

GHANA

Volta Supervision

A $10½ million contract for the engineering design, procurement of major equipment and inspection of construction of the Volta River hydro-electric project has been awarded to Kaiser Engineers and Constructions Inc., of USA, by the Ghana Government. Bids to build the dam and power plant at Akosombo were recently opened and have been submitted to Kaiser Engineers for evaluation and review in their supervisory capacity.

PAKISTAN

Grid Completion Ahead of Schedule

A further stage in the 132 kV Pakistan primary grid, the 155-mile line from Daudkhel to Lyallpur has been completed ahead of schedule. Other sections of this line which will link thermal and hydro stations to load centres are well in hand. The Lyallpur-Lahore section was completed in September last year, work on the Warsak to Daudkhel section is about 80% complete and construction is in hand on the Lyallpur-Montgomery line.

US Loan Offer to WAPDA

For comprehensive electrification, dredging and flood control, the US has offered an Rs28 million loan to Pakistan. The loan will assist financing schemes estimated to cost Rs94,706,000, excluding the foreign exchange component, for the East Pakistan electric system. This section of the loan will finance a link between the Sidhirganj steam station and Karnafuli Dam, and also completion of the Goalpara steam station. The Karnafuli multi-purpose scheme is expected to be completed in April next year.

Four other development schemes for East Pakistan, estimated to cost Rs5·91 crore, were recently approved by the Central Development Working Party. The schemes relate to power, health and social welfare development and include in the first section a 132 kV inter-connector costing Rs3·86 crore, to be completed by 1965. The transmission line will be 140 miles long and will link Comilla to Dacca. It includes a number of substations and branch lines.

INDIA

Approval for Generating Plants

A thermal plant at Korba and a hydro plant at Sharavati, both with a design capacity of 180 MW were recently approved by the Hathi Committee. Total cost of the projects is estimated at Rs60 crore.

Nuclear Caution Counselled

India was advised to be cautious about its nuclear power station programme by a Soviet nuclear official recently. He said Russia was having second thoughts on economics of nuclear power. No new power stations were planned in Russia. He did not agree that India's conditions justified nuclear development.

Railway Electrification Tenders

Tenders for erecting overhead equipment for the Eastern Railway in the Calcutta region were invited recently for the Sealdah-Ranaghat and Dum Dum-Bongaon sections. Following the recent decision to electrify the Madras-Tambaram-Villupuram section at 25 kV a.c., the work is being speeded up and technical details are now being finalised.

Reviewing the performance of Indian railways recently, the chairman of the railway board said that the electrification programme was running behind schedule. Second Plan targets were expected to be achieved by the end of June instead of March. Already more than 100 miles of track had been electrified.

Power Station Extension

The Pathratu thermal station in Bihar district, to be constructed under the Third Plan, is likely to be 250 MW instead of the original 100 MW planned. The extension will have three 50 MW units to enable the station to meet demands from the heavy engineering corporation in Ranchi. Foreign exchange required for the scheme is estimated at Rs12·5 crore.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

10 March—Ballymoney. (3) Electrical installation in left wing improvements Route Hospital. Applications to Secretary, N.I. Hospitals Authority, 27 Adelaide St, Belfast, by above date.

10 March—Dalton-in-Furness U.D.C. Supply and installation of 26 Group "A" sodium vapour lighting units, control gear and steel columns, including erection and wiring of equipment. A. W. Charity, engineer and surveyor, Town Hall, Dalton-in-Furness. Deposit £1 1s.

10 March—Hindley U.D.C. Rewiring and installation of three-pin socket outlets in approximately 140 pre-war council houses. G. Bennett, Housing Manager, Town Hall, Hindley.

10 March—N.E. Metropolitan Hospitals. Applications for inclusion in approved list of electrical installation contractors.—See 2 March issue.

10 March—Sunderland C.B.C. Electrical installations in 277 dwellings, Town End Farm estate.—Advertised 16 Feb. issue.

11 March—Dundee. Electrical installation in third and final development (south block) of Duncan of Jordanstone College of Art, Perth Rd. Apply to Clerk and Treasurer, 40 Bell St, Dundee, by above date.

11 March—Newton Abbot U.D.C. Class "A" street lighting and Class "B" in police station access road.—See 2 March issue.

11 March—West Hartlepool T.C. Supply of seven 25 ft, 45 20 ft and 50 15 ft tubular steel street lighting columns. J. Stanley Miles, Borough Engineer, Municipal Bldgs, West Hartlepool.

12 March—Louth R.D.C. Sewage ejectors with motors, starters and accessories for Legbourne and Little Cawthorpe scheme.—See 2 March issue.

13 March—E. Lothian C.C. Electrical installation in proposed primary school at Tranent. Apply to County Architect, County Bldgs, Haddington, by above date.

13 March—Manchester C.C. Electrical installations in 370 dwellings at Blackley New Rd. Director of Hsg, Town Hall, Manchester 2.

13 March—Southgate B.C. 690 60 W sodium lanterns/gear; concrete columns, 163 140 W sodium lanterns/gear and 25 ft concrete columns, lanterns, etc.—See 2 March issue.

14 March—Kincardine C.C. Electrical work in: 28 houses, Cove Bay; 12 houses, Fettercairn; and 20 houses, Muchals. Applications to County Architect and Planning Officer, Westfield Hse, Stonehaven, by above date.

14 March—Llanelly R.D.C. Lighting on trunk road, A48; 12 steel columns with 140 W sodium discharge lamps; two columns 85 W lamps; 21 140 W sodium discharge lamps.—Advertised 23 Feb. issue.

14 March—Midlothian C.C. Supply of (a) cookers and (b) wash boilers. Applications to County Architect, 32 Palmerston Pl, Edinburgh, by above date.

14 March—Wallasey C.B.C. 570 concrete Group "B" columns and "B" lanterns.—See 2 March issue.

15 March—Wolverhampton C.B.C. (1) Lift and (4) electrical installation in Home for Aged Persons and flatlets, Broadway, Bushbury. Borough Engineer, Town Hall.

16 March—Dun Laoghaire T.C. Public lighting Marine Rd and Park Haigh Terr.—See 2 March issue.

16 March—Stevenage D.C. 200 aluminium columns/lanterns and maintenance service.—See 2 March issue.

17 March—Grimsby C.B.C. (c) Electrical installation in comprehensive school, Ely Rd.—See 16 Feb. issue.

17 March—Hemel Hempstead. Delivery and erection of 51 Class "A" steel solumns and bowl lanterns, 35 ft and 30 ft high, with fog lighting fittings at ground level, for Plough roundabout, for Development Corpn. Chief Engineer, Westbrook Hay.

17 March—Magor and St. Mellons R.D.C. 179 columns/lanterns/gear; laying of cables, etc.—See 2 March issue.

17 March—Pewsey R.D.C. Power installations.—See 2 March issue.

17 March—Tyne Improvement Commissioners. Supply of electric lamps for year ending 30 April, 1962. R. N. Eggleton, secretary, Berwick St, Newcastle-on-Tyne.

17 March—West Hartlepool T.C. Electrical system at High School for Girls. L. Auton, architect, Regent Bldgs, York Rd, West Hartlepool.

17 March—Wilton B.C. Street lighting installation, Seagrim estate and Burcombe La.—See 16 Feb. issue.

18 March—Garforth U.D.C. Annual supplies of electric light bulbs for year ending 1/4/62. G. N. Smith, engineer and surveyor, Council Offices, 5 Main St, Garforth, Leeds.

18 March—Swansea B.C. Electrical installation in central police station.—See 2 March issue.

18 March—Wexford C.C. Electrical distribution scheme, County Hall.—See 2 March issue.

20 March—Antrim C.C. Electrical installation at Lisburn Technical School extension, phase II. Details from K. A. MacCormac, Director of Education. Deposit £5.

20 March—Armagh R.D.C. (1) Two 1,500 g.p.m. motors/pumps with starters, switchgear; remote control apparatus.—See 2 March issue.

20 March—Blackpool T.C. Supply of 120 tubular steel poles, 135 fibreglass bases and collars, 155 Group "A" post-top fluorescent lanterns, 120 c.i. spigots, 165 synchronous solar time switches, and 32 special Group "A" concrete columns. Director of Lighting and Electrical Services, Rigby Rd East, Blackpool.—Advertised in this issue.

20 March—Bolton and District Joint Sewerage Board. Electrical work associated with Ringley Fold sewage treatment wks, involving 415 V air-break switchgear, contactor gear, instrument panel, floodlighting equipment, telephone exchange and cables. Apply to Kennedy and Donkin, consulting engineers, 64 Royal Exchange, Cross St, Manchester, by above date.—Advertised in this issue.

20 March—Hereford C.C. Wiring in 17 bungalows.—Advertised 2 March issue.

20 March—N. Ireland. Electrical installation in battery and broiler houses, Loughry Agricultural College, Cookstown. Documents from Room 103, Law Courts, Belfast.

20 March—Nottingham C.C. Centrifugal well pumps, motors, switchgear, etc., for Basford.—See 2 Feb. issue.

20 March—Ripley U.D.C. Rewiring of 12 houses at Park Rd, Heage. H. Hillier, Surveyor, Town Hall, Ripley, Derby.

20 March—West Riding C.C. (1) Floodlighting of play courts, Swinton Secondary School.—See 23 Feb. issue.

21 March—Armagh. Electrical installation in Convent of the Sacred Heart Grammar School extensions.—See 23 Feb. issue.

21 March—Bedfordshire C.C. (b) Electrical installation in Clapham/Oakley County Secondary School.—See 19 Jan. issue.

21 March—Manchester C.C. (b) Electrical installation in Didsbury Training College extensions.—See 2 March issue.

21 March—N. Ireland. Electrical installation in N. Ireland War Memorial Building, Waring St, Belfast. Details from consultants, McCandless and Barton, 6 Murray St, Belfast 1. Deposit £3 3s.

23 March—Newcastle upon Tyne C.C. Supply of sodium and colour corrected mercury lanterns/gear. General Manager: F. S. Taylor, Transport and Electricity Undertaking, Manors, Newcastle 1.—Advertised in this issue.

24 March—Down C.C. Electrical heating and lighting installation, Taxation Dept., Downpatrick.—See 2 March issue.

24 March—Lanark C.C. Fifteen 140 W sodium discharge lanterns with auxiliary gear, 13 steel columns and 14 steel outreach bracket arms. Assistant engineer (Lighting), 23 Beckford St, Hamilton.—Advertised in this issue.

24 March—Tickhill U.D.C. Supply, erection and wiring of 49 street lighting lamps/lanterns/gear. Details from surveyors: J. Haslam and Sons, Ryton Chmbrs, Newcastle Ave, Worksop. Deposit £2 2s.

25 March—Harpenden U.D.C. Erection of 306 street lamps, for 80 W and 125 W m.b.f./u. lamps. Engineer and Surveyor, Harpenden Hall. Deposit £2 2s.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 116 queries answered this week

"Balarc" arc welding transformers—makers of? C.E.G.B.—Ashton-Young Engineering Development Co. Ltd., 76 Cambridge Rd, Kingston upon Thames, Surrey.

"Duplex" floor polishers—makers of? C.Y.-R.—Electrona Electrical Products Ltd., Islington Mill, James St, Salford 3.

"Little Giant" stocks and dies—suppliers of? W.W.—Markt and Co. (London) Ltd., 250 Goswell Rd, E.C.1.

"Sector" irons—address for? T.E.—Electrical Components Ltd., Components Hse, Ludgate Hill, Birmingham 3.

"Tecam" scientific instruments—makers of? J.B.—Techne (Cambridge) Ltd., Duxford, Cambridgeshire.

"Malag" storage heaters—agents for? P.P.—Mantle and Butterworth Ltd., 53 Bury Rd, Rawtenstall, Lancs.

Clothes drying cabinet with removable fan heater—makers of? A.L.—C. J. Watson (Burnley) Ltd., Neptune Iron Wks, Sandygate, Burnley, Lancs.

"Lexington" waffle irons—address for? L.E.B.—A. G. Field and Co. Ltd., 19 City Rd, E.C.1.

"Veto" switches—agents for? M.W.—Deta (O'seas) Co. Ltd., 15 Monmouth St, W.C.2.

"Nicopress" copper sleeving—makers of? F.D.B.—The National Telephone Supply Co. Ltd., 5100 Superior Ave, Cleveland, Ohio, U.S.A.

27 March—E.B. for N. Ireland. Steam and feed pipework with valves for Coolkeeragh. —See 2 March issue.

27 March—Fylde R.D.C. Supply, erection and commissioning of 13 400 W h.p. m.v. lamps and lanterns, and 153 80 W h.p. m.v. lamps and lanterns on concrete columns or pole-mounted. Engineer and Surveyor, 29a Station Rd, Kirkham, near Preston. Deposit £2 2s.

27 March—Tamworth B.C. 53 200 W sodium lighting units; (2) 14 250 W mercury units on steel columns, etc.—See 2 March issue.

29 March—Birmingham T.C. Supply of 2,500 c.i. columns, Class "B," 2,500 combined lanterns and brackets, 4,000 synchronous time switches, and 500 "keep left" bollards. City Engineer and Surveyor, Civic Centre, Birmingham 1.

30 March—Newcastle upon Tyne T.C. Electrical installation in clinic, garages, duty room and four flats, Kenton North housing estate. City Architect, 18 Cloth Market.

30 March—Stockport T.C. Electrical installations in 62 houses at Canal Bridge Farm Estate, Reddish. Borough Architect, Town Hall.

30 March.—Wandsworth B.C. Electrical contractors invited to apply to be placed on work list. J. Noel Martin, Town Clerk, Municipal Bldgs, Wandsworth, S.W.18.—Advertised in this issue.

4 April—Devizes B.C. Electrical installations and bathrooms at 1-12 Deramore Row. Borough Surveyor, Northgate Hse.

5 April—Aldridge U.D.C. (a) Erection only of three Group "A" columns, 57 Group "B" columns, 15 aluminium columns, and supply and erection of three 250 W mercury vapour lanterns and gear, 30 60 W sodium lanterns and gear, 27 100 W tungsten lamps and lanterns, and 15 m.v. 80 W lanterns and gear; (b) erection of 57 Group "B" columns, supply and erection of 20 100 W tungsten lamps and lanterns, and 37 60 W sodium lanterns and gear. Engineer and Surveyor, The Poplars, 9 Leighswood Rd, Aldridge. Deposit £2 2s.

7 April—Bilston B.C. 280 60 W sodium Group "B" lamps on concrete columns.—See 2 March issue.

10 April—N. Ireland. Supply of household electric appliances and suction cleaners to Nurses' Home, Erne Hospital, Enniskillen. Secretary, Fermanagh Hospital Management Committee, County Hospital, Enniskillen.

17 April—E.B. for N. Ireland. One steam and one motor-driven feed pump for Coolkeeragh.—See 2 March issue.

No date stated—Haddington B.C. (7) Electrical installations in six houses.—See 2 March issue.

No date stated—Jarrow B.C. Applications for inclusion in approved list for supply (List 14) electrical materials.—See 2 March issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

20 March—India. 38 110 kV, 300, 500 and 750 kV distribution transformers. Chief Engineer (South), Store Purchase Section, The Mall, Patiala. B.o.T. (ESB/6841/61).*

21 March—Singapore. 700 street lighting lanterns/lamps/gear and cable (eight items). City Electrical Engineer. B.o.T. (ESB/6499 and 6500/61).*

21 March—Ceylon. House service overhead system, including cables for Dept. of Government Electrical Undertakings. Electrical Engineer, Contracts and Supplies, MacCallum Rd, Colombo. Deposit Rs100, plus Rs5 fee. B.o.T. (ESB/6927/61).*

23 March—India. 33 kV transformers of 300 kVA to 2,500 kVA capacity for Madhya Pradesh Electricity Board. Details from Secretary, at Rampur, Jabalpur. Deposit Rs50.

25 March—Lebanon. 46,500 small bell type glass insulators and 13,000 large bell type ditto for Ministry of Posts, Telegraphs and Telephones, L'Administration des Adjudications Publiques Immeuble Mansour Salame, Rue Georges Picot, Beirut. B.o.T. (ESB/6933/61).*

26 March—Iraq. Ten 400 V 3-ph. distribution boards. Purchase and Tender Office, Iraqi Ports Admin., Basrah. B.o.T. (ESB/6088/61).*

27 March—Canada. Complete supervisory control, master and slave station equipments. D. M. Stephens, Winnipeg Electric Co., P.O. Box 815, Winnipeg. B.o.T. (ESB/5509/61).*

31 March—Burma. Fittings, accessories, washing machines, refrigerators, toasters, vacuum cleaners, cookers (62 items). Commercial Manager, Rangoon Electric Supply, 502 Merchant St, Rangoon. B.o.T. (ESB/6433/61).*

31 March—India. 3·3 kV and 415 V auxiliary switchgear for Amarkantak thermal station. Superintending Engineer (Projects), Madhya Pradesh E.B., Jabalpur. B.o.T. (ESB/5209/61).*

31 March—Korea. One 30 MW steam turbo-generating set for Samchok. Korea Electric Power Co., Seoul. B.o.T. (ESB/32453/61).*

11 April—Rhodesia. Annual supply of cable, boxes and accessories for Salisbury T.C. Town Clerk, P.O. Box 990, Contracts No. S119/61. B.o.T. (ESB/6980/61).*

3 May—Nigeria. 78 mile 33 kV transmission line Aba to Calabar. Secretary, E.C. of Nigeria, 13 Broad St, Lagos. B.o.T. (ESB/4567/61).*

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Jon Electrics Ltd. Resolution for voluntary winding-up passed at meeting on 22 Feb. Mr R. A. Hawken, 1 John St, Bedford Row, W.C.1, appointed liquidator.

Elexa (Domestic Supplies) Ltd. Creditors to send particulars to R. A. Hawken, liquidator, 1 John St, Bedford Row, W.C.1, by 15 March.

Electrahome Ltd. Creditors to send particulars to R. A. Hawken, liquidator, 1 John St, Bedford Row, W.C.1, by 15 March.

Mayfair Electric Ltd. Mr S. G. Banister, 15 Golden Sq, W.1, appointed liquidator, with committee of inspection, on 17 Feb.

Eastronics Ltd. Mr. T. G. C. Hendy, 16 The Traverse, Bury St. Edmunds, and Mr. G. A. Wale, Walter Hse, 418-422 Strand, W.C.2, appointed liquidators as from 31 Jan.

Halpich Ltd. Mr. W. J. Osborne, 14 Finsbury Circus, E.C.2, appointed liquidator at extraordinary general meeting on 10 Feb. for the purpose of voluntarily winding-up.

Bracrealm Electrical Ltd. Winding-up order dated 13 Feb.

J. M. Glauser and Sons Ltd. Creditors to send details to liquidator: A. K. Williams, Argyle Hse, 29-31 Euston Rd, N.W.1, by 20 March.

Hones Electric Ltd. Winding-up order dated 30 Jan.

Don Kenyon Electrical (Nottingham) Ltd. Resolution for voluntary winding-up passed at meeting on 14 Feb. Mr R. C. Ravensdale, 42 Friar Gate, Derby, appointed liquidator.

BANKRUPTCY ACTS

Receiving Order

Chesterfield. Amos Robinson, electrician, trading at 47a Newbold Rd, Chesterfield. Receiving order dated 22 Feb.

Intended Dividends

High Court of Justice. Sidney Ross, formerly trading as Jif Electrical Appliances, and in partnership with another under the name of Newington Electrics, at 98 Matthias Rd, N.16. Trustee: Mr A. A. Walter, Bankruptcy Bldgs, Carey St, W.C.2. Last day for receiving proofs: 14 March.

Manchester. Norman Joseph Parkes, formerly trading in co-partnership with another as Trivox Electric, at 54 Corwen Ave, Hanpurhey, Manchester. Trustee: Mr W. H. Meredith, 20 Byrom St, Manchester. Last day for receiving proofs: 14 March.

CONTRACTS PLACED

Darlington. Electrical equipment in additions to Darlington College of Further Education, J. Peterson and Son, £22,104.

Durham C.C. Electrical work at E. F. Peile County Convalescent Home, William Bros. Electrical Ltd., £1,377; installation at East Boldon residential nursery, Campbell and Isherwood, £1,079.

Hebburn U.D.C. Electrical installation in 42 houses, Cook and Nicholson, £1,251.

Sunderland T.C. Electrical installation in 260 dwellings at Town End Farm estate, J. Calvert (Electrical), £4,363.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Elgalite. B805,775. Class 9. Scientific and electrical apparatus, etc. Elga Products Ltd., Lane End, Bucks.

Envoy. 812,269. Class 9. Television aerials, etc. Belling and Lee Ltd., Gt. Cambridge Rd, Enfield, Middx.

Turboflo. B806,260. Class 11. Heating apparatus, etc. Engelhard Hanovia Lamps, Bath Rd, Slough, Bucks.

TRADE NOTES

Changes of Address. The London office of Ottermill Switchgear Ltd. has moved to 166 Victoria St, S.W.1. The telephone no. remains Abbey 5095.

Walmore Electronics Ltd. have moved to 11-15 Betterton St, Drury La, W.C.2. Telephone Temple Bar 0201.

The Newcastle depot of Pritchett and Gold and E.P.S. Co. has been transferred to 20 Bankwell La, off High Level Bridge Approach, Gateshead-on-Tyne 8. Telephone Gateshead 70034.

Peerless and Ericsson Ltd. announce that their Costing Dept has been moved to the King's Norton factory, Birmingham, and the Accounts Dept is now at Woking, Surrey, head offices of the parent company, Kenwood Manufacturing.

Agents. The Brutv Engineering Co. Ltd., 38 Dawson St, Dublin, have been appointed sole agents in Eire for the L.E.W. group of companies, including the London Electric Wire Co. and Smiths Ltd., Frederick Smith and Co. and the Vactite Wire Co. Ltd., and will hold stock of bare and covered wires. They will also represent Printed Circuits Ltd., and Millett Levens (Engravers) Ltd.

Magco Ltd., Lake Wks, Portchester, Hants, have been appointed sole selling agents in the British Isles for the Binder Magnete Co., of Germany, for their magnetic chucks and accessories.

B. J. Caraher (Distributors) Ltd., 26-28 Alfred St, Belfast 2, have been appointed sole agents in Northern Ireland for all Dimplex products.

New Factories. Martindill Ltd. are transferring production to a new factory in Turkey Rd, Bexhill.

Mectest Ltd. propose to build a factory at Ottery St. Mary for the manufacture of sub-miniature radio sets to be used to provide B.O.A.C. passengers with music and entertainment programmes.

THE ENGLISH ELECTRIC GROUP

Lord Nelson of Stafford on More Effective Use of Britain's Technical Resources

THE Annual General Meeting of The English Electric Company Limited will be held on March 23rd in London. In the course of his statement circulated to stockholders, the Chairman, Lord Nelson of Stafford, said:

Output for 1960 was practically identical with that for 1959. Orders booked in 1960 were substantially higher than ever before and as a result there are good prospects for increased output in 1961. The Parent Company and certain of its subsidiaries showed substantially better results in 1960 than in the previous year. However, after allowing for adverse factors there is a Group profit after tax applicable to members of the Company of £3,142,580 compared with £3,125,870 last year.

Investment for the Future

The immense developments in the electrical industry since the war have necessitated great research and development effort, larger workshops and machine tools, testing equipment of greater capacity and a considerable investment in education and training. You can therefore be confident that we have equipped ourselves to meet any future demands made upon us.

Rationalisation by merging of interests, research agreements and other methods is constantly under review to avoid wasteful duplication.

Unfortunately, the word rationalisation is sometimes misunderstood. It should not raise fears in the minds of those who work in industry because of changes which may take place in their employment, for the aim of such moves is to bring more work to this country and to ensure greater stability of employment.

Competition in Export Markets

Your Company has always played a leading part in export business, and something approaching a third of our great output goes abroad.

We must emphasise that 50 per cent. of our costs are for raw materials and manufactured accessories, and we believe that those firms who supply us with them must also concentrate on cost reduction and share with us the responsibility of obtaining some of the overseas business now being lost to foreign competitors.

The Government's medium term export credit insurance period is often not long enough for capital goods and too expensive as compared with facilities offered by other countries. We, therefore, welcome the Government's assurance of encouragement to export business by improved credit facilities.

Manufacture Overseas

Political and economic changes occurring in all parts of the world are affecting British business in two principal ways. In the first place, many countries had been industrialised in the past by British finance and enterprise and many of their undertakings were staffed by British engineers, who naturally had a tendency to accept automatically British standards and British equipment. In modern conditions these ties have been greatly loosened and what were previously regarded primarily as British markets are now scenes of intense international competition.

In the second place, many countries wish to move from an economy based mainly on primary industries to one including an increasing element of manufacture. I, personally, welcome these changes because I believe that they offer us even greater opportunities for export of capital goods in the future.

For this and other reasons your Company has played its part in developing overseas manufacture having established factories in Canada, Australia, South Africa and India. These activities also enable us to maintain a selling organisation ready to meet these countries' needs and able to deal with special projects involving the importation of British equipment.

Power Generation

We continue to play a part in the British power programme and during 1960 our Atomic Power consortium with Babcock & Wilcox and Taylor Woodrow received the order for the Sizewell nuclear power station, the largest yet ordered anywhere in the world.

Among several important orders received is that for a 375 MW set, one of the first two units in the British power system employing steam at supercritical pressure. The C.E.G.B. have subsequently placed an order for even larger units of 500 MW each

Traction

The traction activities of English Electric and our subsidiaries, Vulcan Foundry and Robert Stephenson & Hawthorns, as last year, have been mainly concerned with the re-equipment of British Railways. By the end of the year we had delivered more than 200 complete electric and diesel-electric locomotives of various types. We have now commenced delivery of the Deltic diesel-electric locomotives, the most powerful to be built anywhere in the world.

Last year I gave a warning regarding the proposed revision of the Programme for British Railways, which threatens to slow up the orders necessary to keep our shops in stable employment. As time goes on we shall have to rely more and more on our export sales to do this.

Computers

The Company's Deuce electronic computer is well known. An important development is the construction of a second generation of fast high capacity computers for general applications.

Domestic Appliances

The big expansion in your Company's domestic appliance operations was temporarily checked by the restrictions imposed on hire-purchase transactions. The need for control upon credit is admitted, but the fluctuations in restrictions make it difficult for manufacturers to plan for the production and sales of these products.

Aviation

I am pleased to say that the new grouping of aircraft companies forming British Aircraft Corporation, in which your Company has a 40% interest, has engendered the warmest collaboration at all levels and we look forward to the future with confidence.

Aircraft Electrical Equipment

The Aircraft Equipment Division of your Company at Bradford has now fully established its position in the aircraft electrical equipment industry.

Other Activities

Successes were recorded in the many other activities of the company.

Marconi's Wireless Telegraph Company

The company has maintained the level of turnover but trading profit is unfortunately down. However, there is an increase in the intake of orders. Our principal subsidiary, Marconi Instruments Limited, has had another very successful year.

Marconi's have again made a notable contribution to Britain's export trade, half our total output going overseas. You will be particularly interested to know that we are engaged in the exciting field of communications by satellites.

Marconi equipped television and broadcasting stations were completed in the United Kingdom, Australia, Brazil and Nigeria and were ordered by New Zealand, Canada, Venezuela, Mexico, the British Broadcasting Corporation and the Independent Television Authority.

The year under review has been one of steady progress in almost every direction and we can face the future with confidence.

Marconi International Marine Communication Company Limited

There has been some improvement in shipping generally during the year. While the greater proportion of our output has been for radio equipment for new British tonnage, we have considerable business in hand for equipping foreign flag vessels and a higher proportion of our production than ever before is going to fulfil these orders. They come from all parts of the world and are for all types of Marconi marine equipment.

English Electric Valve Company

The company has again improved output and turnover and maintained trading results at a very satisfactory level.

D. Napier & Son Limited

There has been no improvement in the results for 1960. Important organisational changes have been made with a view to more efficient operation and a fuller exploitation of existing products. Further Government contracts are expected for the Gazelle helicopter engine.

BUSINESS PROSPECTS

Amble. Housing developments, Ocean Rd, proposed by J. Campbell Smith, North Banks.

Angus C.C. Tender: Further Education Centre, Arbroath. County Architect, Forfar.

Aylesbury. B.C. approved plans for 163 houses proposed by H. C. Janes Ltd., 189 High Town Rd, Luton.

Ayrshire. County E.C. plan technical colleges at Ayr and Kilmarnock, £682,000 and £831,000, respectively. Architect: R. G. Lindsay.

Barton-on-Sea (Hants). Mew, Langton and Co. Ltd., Southampton, plan to erect hotel on a corner site fronting Sea Rd.

Beeston and Stapleford. Multi-storey flats at Queen's Rd proposed by C. T. Whiting (Investments) Ltd., Long Eaton; 39 flats, Cedar Ave, proposed by Sherwood Construction Co. Ltd., Beeston.

Birmingham. 16-storey office block is planned for Hagley Rd, Edgbaston, for Bernard Sunley Investment Trust. Architect: John Madin, 83 Hagley Rd, Birmingham.

Bournemouth. Plans for block of 12 flats for Casbah Ltd; three-storey block of flats, Grosvenor Rd, for Keythorpe Development (Southern) Ltd.; three-storey block of 12 flats, Marlborough Rd, for A. D. Smith; four-storey block of 12 flats, Richmond Park Rd, for Castle Homes Ltd.; and 12-storey block of 45 flats, Manor Rd, for Avon Property Investment Co.

Brentford. Two-storey extension at Jubilee Wks, Great West Rd, proposed to plans by Charity, Thirtle and Duke, 342-6 Grand Bldgs, Trafalgar Sq, W.C.2.

Bridgwater. £30,000 factory scheme approved in principle by B.C., for a site at Colley La for Herb-Royal Ltd.

Brighton. Plans for: nine-storey block of flats, Abbotts Hotel site, King's Rd, for Brighton Residential Hotels Ltd.; 44 flats, London and Tongdean roads, for Greyfriars (Worthing) Ltd.; 32 houses, Hollingdean estate, for Woodside Housing Association; and 18 flats, East Drive, for Francis Group of Companies.

Caernarvonshire C.C. Tender: Fire and ambulance station. County Architect.

Carlisle T.C. Plans by Johnson and Wright, for school at Morton.

Castle Ward (N'land). Cunningham and Forster, Newcastle, to erect houses on ten acres at Coach La, Hazlerigg. Architects: Newcombe and Newcombe.

Charvil. Rened Ray (Builders) Ltd., Bracknell, to erect 32 houses, Park Drive Rd.

Chesterfield. Plans for: 37 houses, Somersall La, for P. Hassall Ltd., Dronfield; 61 houses, 15 bungalows, off Ashgate Rd, for J. H. Fryer Ltd., Derby; ten houses, off Old Rd, for A. F. White Ltd.

Croydon. Plans for: 34 maisonnettes, 17 flats, Mitcham Rd, for A. J. Wait and Co. Ltd., New Malden; 30 flats, Violet La, for A. Grossman; 12 houses, Selsdon Rd, for C. J. E. Kingston; 54 flats, Altyre Rd, for Parkway Estates Ltd.; 24 houses, 12 flats, Knighton Hotel site, Pampisford Rd, for Wellwood Estates Ltd.; eight flats, Warham Rd, for Cheam Builders Ltd.; 21 flats, Down Cottage, Violet La, for A. G. Crossman; and 22 houses, Spout Hill, for New British Garden Estates Ltd., Addington.

Dartford (Kent). 23 houses, Spurrell Ave, J. Stevens Ltd., Welling.

Dudley. B.C. to seek sanction to borrow £386,854 for new halls of residence proposed at Dudley Training College.

Eastbourne T.C. Tender: 38 flats, rear of Faygate Rd and Binsted Close. Surveyor.

Filey U.D.C. Tender: five dwellings, six flats, four houses, Queen St. Architects: Blackmore, Son and Co., Lowgate, Hull.

Gateshead. Arthur and Kirkup, architects for new stores for Carruthers and Son; outline plans approved for converting Rex Cinema into shop and offices, architect: E. M. Lawson, Barras Bldgs, Newcastle; plans for block of shops in Durham Rd for Ceres Investments Ltd., architects: Bartlett and Gray, Nottingham.

Glasgow. Residential hostel for 150 students proposed in Great Western Rd area by Glasgow and West of Scotland Domestic College.

Great Yarmouth. 10,000 sq ft factory at Southtown proposed by William Clowes and Sons, printers, London.

Hampshire. County Health Committee proposals for health clinic and ambulance station, Leigh Park, Portsmouth.

Hastings. Plans for: 32 bungalows and houses, Grosvenor Nurseries site, Fairlight Rd, for Fordwater Estates Ltd., plans by Stace and Sons, St. Leonards; 11 bungalows, Pilot Rd, for Chartres Chadburn Ltd., plans by H. Ward and Ptnrs., architects.

Hook. Development of nearly seven acres at Newnham Rd, with 53 houses and bungalows, proposed by Fixed Homes (Ash) Ltd.

Horsham. Tender: new offices, Hurst Rd, for N.W. Sussex Water Board.

Hove. Plans for erection of hotel and flats for Villapost Ltd., £700,000. Architects: Morgan and Carn, 12 Grand Ave.

Hunts C.C. New primary school at Stilton proposed.

Lanarkshire. Coatbridge Dean of Guild Court approved development at Kirkwood for Caledonian Tractor and Equipment Co. Ltd. (£150,000); at Whifflet Foundry, for R. B. Tennent Ltd. (£195,000).

Leamington Spa. Plans for: 44 flats, Lillington Ave, 24 flats, Warwick Pl, for A. C. Lloyd (Builders) Ltd.; 42 flats, Avenue Rd, for Blackburn Ltd.; 33 flats, The Grange, for R. M. Wilson (Builders) Ltd.

Leeds. John Liversedge and Associates, 42 Portland Pl, London, structural consultant engineers for abattoir and wholesale meat market.

Leics C.C. New council offices at Anstey Frith, proposed.

Liverpool. Corporation approved £10 million scheme proposed by Ravenseft Properties Ltd., London W.1, for redevelopment of St. John's market area, involving eight-storey hotel, two blocks of shops, car park and covered shopping arcade; complete rewiring of Town Hall, modernisation of lifts approved in principle by Finance and General Purposes Committee.

London. Plans for: five-storey extension for offices, storage and engineering shop, Mayes Rd, for Caxton Chocolate Co. Ltd., N.22, plans by Hugh V. Sprince, architect; new factory and office space proposed for Chambon Ltd., Hammersmith, plans by J. Mathewson; Elizabeth Arden Ltd. to erect four-storey extensions, Wales Farm Rd; seven-storey block of flats, Lowndes St and West Halkin St, S.W.1, proposed by Capital and Counties Property Co. Ltd., architects: Sir Lancelot Keay, Basil G. Duckett and Ptnrs.; block of flats, Belsize Rd, to be erected by S. A. Thorne and Sons Ltd., architect: W. J. Harvey, Dollis Hill La; showrooms and offices proposed at High St, E.16, to plan by Anders and Dalton, architects, 98-100 High Rd, Ilford; Chamberlain Group of companies to redevelop site at junction of Fleet St and Chancery La; Clyde Young and Bernard Engle, 8 New Sq, W.C.2, are architects for ten-storey block of flats, 77 Shepherds Hill, Highgate; planning approval received for erection of eight-storey extension to Mandeville Hotel, W.1, architects: Katz and Vaughan, 208a Regent St; shops and offices to cost £50,000 planned at 161-169 Uxbridge Rd, W.13, architects: D. Stern and Ptnrs.; plans being prepared by Norman Green, architect, 12 Adeline Pl, W.C.1, for offices (£200,000) at junction of Berwick St and Noel St, W.1.

Luton. Plans for: 144 dwellings, Limbury Mead, for H. C. Janes Ltd.; ten-storey block of flats at Fairholme site, Hart Hill Drive, for T. J. James; three multi-storey blocks of flats at Larches site, Old Bedford Rd, for Walter King Property and Management Co. Ltd.

Maidenhead. Erection of 122 houses and eight maisonnettes, Boyn Hill Rd, planned by Laurence Weaver Ltd., Slough.

Maidstone. Plans for: 48 dwellings, Boxley Close, for C. K. Bartlett; 14 maisonnettes, Upper Fant Rd, for E. H. M. Sargeant; and eight houses, Glebe La, for R. Lawrence and Sons.

Middlesbrough. Allison and Hutchison, Edinburgh 3, architects for extensions to Constantine Technical College.

Northants C.C. £150,000 library/offices scheme, Angel St, approved.

Partington (Ches). £46,000 contract placed with J. Gerrard and Sons Ltd. for stage 3 of factory extensions for Styrene Co.-Polymers Ltd., Partington industrial estate. Architects: Scherrer and Hicks, London.

Peterborough C.C. £200,000 indoor swimming pool proposed.

Radnorshire C.C. Tender: primary school, Newbridge-on-Wye. County Architect.

Reigate T.C. Tender: 14 dwellings, Redhill. Engineer and Surveyor.

Rotherham. Factory on Eastwood trading estate proposed by Balfour Laboratories Ltd., Sheffield 9.

Runcorn U.D.C. Tender: bus station in town centre. Surveyor.

St. Albans. New industrial estate on ten-acre site near Hatfield Rd planned by Ronald Lyon (Estates) Co. Ltd., Walton-on-Thames.

St. Leonard's. £25,000 additions planned at St. Augustine's School. The Convent of Our Lady. Architects: B. Stevens and Ptnrs., Havelock Rd, Hastings.

Salford. Erection of maternity unit at Hope Hospital proposed by Manchester Regional Hospital Board. Architects: Cruickshank and Seward.

Salisbury. City Engineer to prepare draft scheme for indoor swimming pool, Bourne Hill.

Sheffield. Rider, Hunt and Ptnrs., Queen Victoria St, E.C.4, quantity surveyors for erection of modern store.

Shropshire. Welfare Committee plan old people's homes at Shrewsbury and Oswestry, costing £152,000.

Skegness U.D.C. £80,000 factory to be leased to Murphy Radio Ltd., proposed.

Smethwick. Tender: factory at Oldbury Rd for United Spring Co. Ltd. Architect: J. Rendle, 1 Leicester St, Walsall.

Southwick U.D.C. Tender: 74 flats at two sites. Clerk of the Council.

Staines U.D.C. Tender: 44 dwellings, Town La, Stanwell. Clerk to Council.

Stratford upon Avon T.C. Tender: 16 flats, 18 houses, Masons Rd. Engineer.

Sunderland. Vaux and Associated Breweries Ltd., to covert mansion, Rose Dene, into public-house. Outline plans prepared by G. T. Brown and Son.

Swansea. Work to start in October on revised Stage II of Singleton Park Hospital, to cost £1¼ million.

Tonbridge (Kent). Extensions and a south wing to cost £100,000 proposed by governors of Tonbridge School. Architects: Sir William Holford and Ptnrs., London.

Twickenham. War Office plan junior ranks' mess at Kneller Hall School of Music.

Wednesbury. Factory planned at Portway Rd, for R. F. Steward Ltd., 2 Holden Rd. —Factory extensions, Portway Rd, for Prodorite Ltd., Eagle Wks.

Wells-next-the-Sea U.D.C. Tender: Improvements to 62 houses. Architect, 36 Cattle Market St, Norwich.

Whitworth U.D.C. Tender: 36 dwellings, Moss Side St, Shawforth. Engineer.

York. Extensions (£130,000) planned at West Riding of Yorkshire Agricultural Institute, Askham Bryan.

MEETINGS TO NOTE

THURSDAY, 9 MARCH

I.E.E. (Supply Section). Dinner-dance. Connaught Rooms, W.C.2. 7.30 p.m.

I.E.E. (N. Scotland). "Generator/Motor Problems in Pumped-Storage Installations," J. H. Walker. Electrical Engineering Dept., Queen's College, Dundee. 7 p.m.

I.E.E. (W. Wales). "Some Considerations in the Application of Power Rectifiers and Converters," J. P. McBreen. Conference Room, S.W.E.B., The Kingsway, Swansea. 6 p.m.

I.E.E. (Irish). "Design Manufacture and Service Performance of Rural Transformers in Ireland," W. G. Scaife and M. P. Kealy. Physical Laboratory, Trinity College, Dublin.

SOCIETY OF INSTRUMENT TECHNOLOGY (Liverpool). "Design Application and Selection of Automatic Control Valves," P. Stone. M.A.N.W.E.B. Industrial Development Centre. 7 p.m.

I.E.S. (Manchester). "Blackpool Illuminations," H. Carpenter. Illuminations and Electrical Services Department, Rigby Rd, Blackpool. 2.30 p.m.

I.E.E. (N.E. Graduates and Students). "Distribution Planning," P. A. Balmbra. Sunderland Technical College. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Scottish). "High Speed Pulse Techniques," E. Wolfendale. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow. 7 p.m.

A.S.E.E. (Bradford and District). "Trolleybus Control," D. Francis. The Midland Hotel. 7.30 p.m.

FRIDAY, 10 MARCH

I.E.E. (N. Eastern). Annual dinner and dance. Old Assembly Rooms, Newcastle upon Tyne. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Midlands). "Control Problems of Nuclear Power Stations," R. B. Quarmby. Lecture Theatre of the Byng Kendrick Suite, at the Gosta Green College of Technology, Aston St, Birmingham. 7 p.m.

I.E.S. (Bath and Bristol). Dinner and dance. Hawthorns Hotel.

SATURDAY, 11 MARCH

I.E.E. (Sheffield Graduates and Students). Week-end Conference at Bridlington.

MONDAY, 13 MARCH

I.E.E. Discussion: "Town Planning and Electrical Requirements." Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (E. Anglian). Discussion: "The Broadening of University Engineering and Science Courses." Technical College, Cambridge. 6.30 p.m.

I.E.E. (Western). "Silicon Power Rectifiers," A. J. Blundell, A. E. Garside, R. G. Hibberd and I. Williams. S.W.I.E., Cardiff. 6 p.m.

I.E.E. (N. Eastern). "A Basis for Short-circuit Ratings for Paper-insulated Cables up to 11 kV," L. Gosland and R. G. Parr; "Short-circuit Ratings for Mains Cables," G. S. Buckingham. Neville Hall, Newcastle upon Tyne. 6.30 p.m.

I.E.E. (S. Midlands Supply and Utilisation Group). "The Determination of the Electrical Characteristics of an Arc Furnace," J. Ravenscroft. College of Advanced Technology, Gosta Green, Birmingham. 6 p.m.

I.E.E. (Scottish Electronics and Measurement Group). Discussion: "Digital Transducers." Royal College of Science and Technology, Glasgow. 6 p.m.

INSTITUTION OF MECHANICAL ENGINEERS. Discussion: "Cybernetics." 1 Birdcage Walk, S.W.1. 9.45 a.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Bristol). "The Industrial Use of Precision Scales," P. A. McKeown. University of Bristol, Dept. of Physics, The Royal Fort. 7.30 p.m.

I.E.S. (Sheffield). "Use of Coloured Light," H. Hewitt. Grand Hotel. 6.30 p.m.

A.S.E.E. (Bournemouth and District). Tape Recording of A.S.E.E. Diploma Scheme and lecturettes. Grand Hotel, Firvale Rd. 8 p.m.

A.S.E.E. (N.W. London). "Electric Clocks," D. F. Burgess. Century Hotel, Wembley. 8.15 p.m.

TUESDAY, 14 MARCH

I.E.E. (Education Circle). Discussion: "New Routes into National Certificate and Technician Courses." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (N. Ireland). "Some Engineering Aspects of the *Canberra*," J. H. Crossey. Civil Engineering Dept., David Keir Bldg, Queen's University, Stranmillis Rd, Belfast 9. 6.30 p.m.

I.E.E. (N. Midlands). "Developments in Lighting," F. A. Benson. H.Q. Mess, School of Signals, Catterick Camp. 6.15 p.m.

I.E.E. (N. Midlands). Discussion: "Refresher and Post-Graduate Course for Electrical Engineers." Electrical Engineering Dept., Leeds University. 6.30 p.m.

I.E.E. (Southern). "Analogue to Digital Converter Techniques and Their Applications," K. L. Smith. The University, Southampton. 6.30 p.m.

I.E.E. (N. Western). "The Place of Formal Study in the Post-Graduate Training of an Electrical Engineer," N. N. Hancock and P. L. Taylor. Engineers' Club, Albert Sq, Manchester. 6.15 p.m.

I.E.E. (Scottish Electronics and Measurement Group). Discussion: "Digital Transducers." Carlton Hotel, Edinburgh. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Manchester). Brains Trust on "Maintenance." Nags Head, Jacksons Row. 6.45 p.m.

INSTITUTION OF CIVIL ENGINEERS. "The Design and Construction of Bombay Marine Oil Terminal," Sir Bruce White, C. R. White, A. H. Beckett and P. E. Golvalv. Gt. George St, S.W.1. 5.30 p.m.

ELECTRICAL ASSOCIATION FOR WOMEN. "Cameo of Holland," Antonia Speller. 25 Foubert's Pl, W.1. 6 p.m.

A.S.E.E. (Aldershot and Districts). "Codes of Practice," S. J. Emerson. Queen's Hotel, Lynchford Rd, Farnborough. 8 p.m.

A.S.E.E. (Chester and District). "Ball and Roller-Bearings," T. S. Nisbet. Westminster Hotel, City Rd. 7.45 p.m.

A.S.E.E. (E. Kent). "Oil-fired Boilers and Associated Equipment," S. Austin. Clarendon Hotel, Broadstairs. 8 p.m.

A.S.E.E. (Glasgow). "Electronics," R. H. Garner. Kenilworth Hotel, Queen St. 8 p.m.

A.S.E.E. (Leicester). Dance. Saxon Room, Westcotes Constitutional Club, Wilberforce Rd. 7.30 p.m.

A.S.E.E. (Portsmouth and District). "Decca Navigational System." Committee Rooms, Ministry of Labour Offices, Lake Rd. 7.30 p.m.

A.S.E.E. (S. Wales). "Control Centres for Modern Industries." Park Hotel, Park Pl, Cardiff. 7.30 p.m.

A.S.E.E. (York). "Electrical Safety in Home and Factory," F. Clark. Royal Station Hotel. 7.30 p.m.

WEDNESDAY, 15 MARCH

I.E.E. (Supply Section). Discussion: "Magneto-Hydrodynamic Generation of Electricity." Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N. Lancs). The Second Hunter Memorial Lecture: "The Protection of Electrical Systems," H. G. Bell, N.W.E.B. Demonstration Theatre, Friargate, Preston. 7.30 p.m.

I.E.E. (S. Western). "The Shielding of Overhead Lines Against Lightning," J. H. Gridley, Washington-Singer Laboratories, Exeter University, Prince of Wales Rd, Exeter. 3 p.m.

I.E.E. (Rugby). "The Determination of the Electrical Characteristics of an Arc Furnace," J. Ravenscroft. Rugby College of Engineering Technology. 6.30 p.m.

I.E.E. (N.W. Electronics and Communications Group). "The Potentialities of Artificial Earth Satellites for Radiocommunications," W. J. Bray. Engineers' Club, Albert Sq, Manchester. 6.15 p.m.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

B. and H. Electrical Engineers (Ferndown) Ltd., 11 Hadrians Close, Ferndown. Nom. cap.: £500. Dirs.: Douglas R. Burroughs, Dennis A. Harris, Daphne E. Burroughs and Marion O. Harris.

Clear Line (Electronics) Ltd. Nom. cap.: £10,000. Dirs.: Vivian L. Scott, 3 St. Peter St, Tiverton; Leonard A. Scott and Denys G. Rhodes.

Crown Appliances (Wholesale) Ltd., 18 Gipsy Hill, S.E.19. To carry on business of wholesalers of household appliances, etc. Nom. cap.: £1,000. Dirs.: John F. Palmer and Eva M. Palmer.

Gnome Heaters Ltd., Moll Spring Wks, Netherton, Huddersfield. Nom. cap.: £200. Dirs.: Jack Brook, John Hinchliffe and Peter Taylor.

Geo. A. Kelly (Electrical) Ltd., 63 Shaw St, Liverpool. To carry on business of electricians, etc. Nom. cap.: £1,000. Permanent dirs.: George A. Kelly and Marie J. Kelly.

S. E. State Ltd., 32 Dover Rd, Walmer, Kent. manufacturers of and dealers in telephonic apparatus, industrial and electrical apparatus, etc. Nom. cap.: £10,000. Dirs.: Sydney E. State and Iris State.

I.E.E. (N.W. Graduates and Students). "Digital Techniques in Power Engineering," C. Ayers. Manchester University, Electrical Engineering Dept. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Data Processing Section). Symposium on Burst Slug Detection in Nuclear Power Stations. Manson Hse, 26 Portland Pl, W.1. 7 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Merseyside). "Flight Simulators," D. J. Mauchel and R. Marvyn. Adelphi Hotel, Liverpool. 7 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (S. Western). "Airborne Servo System for Throttle Control," D. W. Thomasson. School of Management Studies, Unity St, Bristol. 7 p.m.

A.S.E.E. (Nottingham). Open Forum: "Planning of Electrical Installations With Reference to Electrical Contractors and Architects." Nottingham Mechanics Institution, Trinity Sq. 7.30 p.m.

A.S.E.E. (Wolverhampton and District). "Summation Metering," M. L. Dunn. Chamber of Commerce, District Bank Chmbrs, Lichfield St. 7.45 p.m.

THURSDAY, 16 MARCH

I.E.E. (Utilisation Section). "A Dynamic Model for Studying the Behaviour of the Overhead Equipment Used in Electric Railway Traction," D. S. Farr, H. C. Hall and A. L. Williams. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Scottish). Annual dinner. Adam Rooms, Edinburgh.

I.E.E. (Southern Graduates and Students). Discussion: "Electrical Engineering Education and Training." The University, Southampton. 6.30 p.m.

CHELMSFORD ENGINEERING SOCIETY. "Model Engineering," R. H. Fuller. Crompton's Social Hall. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (E. Midlands). "Recent Developments in Industrial Electronics," E. Metcalf. Derby and District College of Technology, Kedleston Rd, Derby. 7.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Newcastle). "The Rotameter Sheds its Limitations," H. Williamson. Conference Room, Roadway Hse, Oxford St. 7 p.m.

INSTITUTION OF PRODUCTION ENGINEEERS (Southern). "Production Techniques in the Instrument and Telephone Industry," H. A. Richardson. New Basingstoke Technical College, Worthing Rd, Basingstoke. 7.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Electro-Acoustics Group). "Transistorised Tape Recorders," S. Welldon. London School of Hygiene and Tropical Medicine, Keppel St, Gower St, W.C.1. 5.30 p.m.

FRIDAY, 17 MARCH

I.E.E. (N.E. Graduates and Students). "Preparation and Presentation of Papers," H. S. Hvistendahl. Joint meeting with Institutions of Civil and Mechanical Engineers. Rutherford College of Technology. 6.30 p.m.

A.S.E.E. (Stoke and Crewe). "Lift Installation and Maintenance," J. E. Collins. Grand Hotel. Hanley. 7.30 p.m.

MONDAY, 20 MARCH

I.E.E. (Western Supply Group). "Construction of Nuclear Power Stations," D. M. Longman. Demonstration Theatre, Electricity Hse, Bristol 1. 6 p.m.

I.E.E. (N. Staffs). Short Papers Evening. (Joint meeting with Graduates and Students.) County Technical College, Stafford. 7 p.m.

I.E.E. (S. Midland). "Radiocommunications by Means of Satellites," A. W. Lines. Winter Gdns, Gt. Malvern. 7.30 p.m.

I.E.E. (Sheffield). Centre chairman's address. F. W. Fletcher. Angel Hotel, Brigg. 6.30 p.m.

I.E.E. (N.E. Measurement and Electronics Group). "New Amplifying Techniques," Professor C. W. Oatley. Rutherford College of Technology, Northumberland Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (Reading). "The Development of Eurovision," M. J. Pulling. George Hotel, King St, Reading. 7.15 p.m.

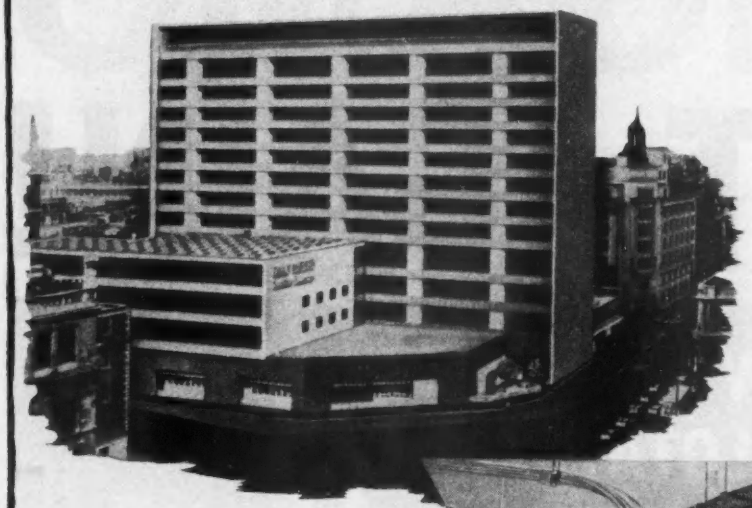
BIRMINGHAM ELECTRIC CLUB. A.G.M. Grand Hotel. 6.15 p.m.

I.E.E. (N. Western). Discussion: "Experimental Methods with Particular Reference to Transistors." Manchester College of Science and Technology. 6.15 p.m.

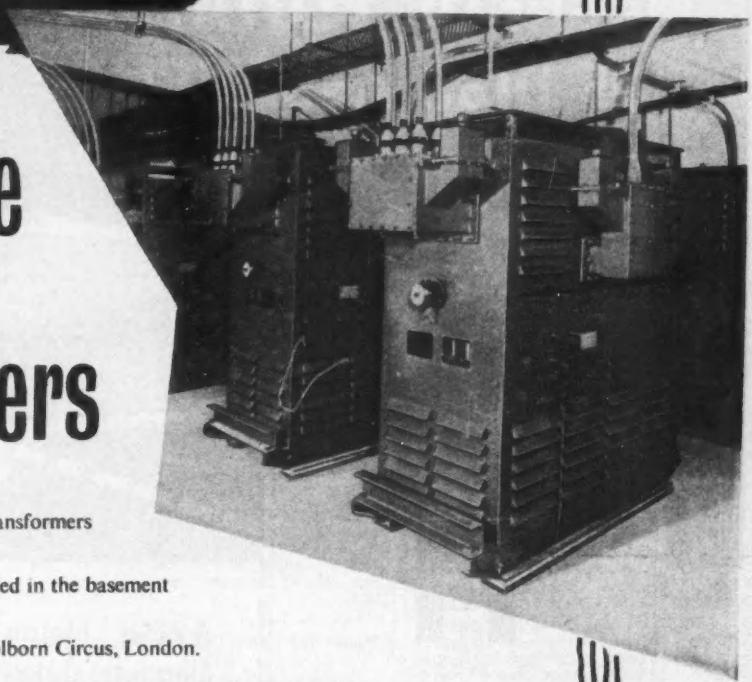
I.E.S. (Bath and Bristol). Symposium with Architects. Gardiner, Sons and Co., Showroom.

I.E.S. (Leeds). "Revised Code of Practice for Lighting in Buildings," H. Hewitt. British Lighting Council 24 Aire St. 6.15 p.m.

IPSWICH AND DISTRICT ELECTRICAL ASSOCIATION. "Electric Floor-warming," L. Shepherd. Electric Hse. 7.15 p.m.



Artist's impression of the new Daily Mirror building at Holborn Circus.



Hackbridge

CLASS C INSULATED

Transformers

Ten 1,000 kVA Hackbridge dry type transformers with class C insulation have been installed in the basement of the new Daily Mirror Building at Holborn Circus, London.

A number of these units are illustrated on the right. The total capacity of Hackbridge class C transformers installed exceeds 50,000 kVA. Send for publication DB.31.

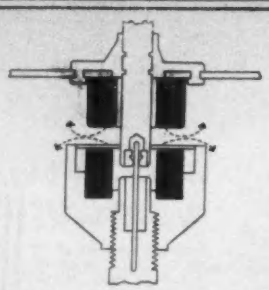
HACKBRIDGE & HEWITTIC ELECTRIC COMPANY LIMITED

Telephone Walton-on-Thames 28833 (8 lines) Telegrams & Cables "Electric, Walton-on-Thames"

SANGAMO FIRST AGAIN!

NEW MAGNETIC FLOTATION OF DISC ASSEMBLY

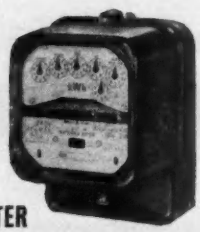
eliminates lower-bearing wear



Two cylindrical Barium-ferrite ceramic magnets, of high coercive force, act with opposing magnetic fields to float the disc completely on a magnetic cushion having a generous clearance of approximately $\frac{1}{16}$" in depth. These magnets, which are surrounded by Mu-temp metal to give full temperature compensation over a range —40°C to +80°C, act as weight neutralizers. Because there is no load or thrust there is virtually no bearing to wear or replace. Accuracy is sustained . . . and maintenance is eliminated.

* New "Floton" bearing gives complete magnetic flotation of disc assembly.
* Even longer life. * No maintenance.
* Unlimited sustained accuracy.

Sangamo are first in production with magnetic flotation of the disc assembly, completely eliminating bearing wear, giving even longer life and sustained accuracy to the world's longest life meter.



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SW 182

CLASSIFIED ADVERTISEMENTS

PUBLIC NOTICES

E.A.W. Certificate for Demonstrators and Saleswomen

The E.A.W. EXAMINATION IN ELECTRICAL HOUSECRAFT (Theoretical) will be held on Thursday, 15 June, 1961, from 2 p.m. to 5 p.m., at various centres in Great Britain.

Full particulars and entrance forms may be obtained from:

Examinations Department,
The Electrical Association for Women,
25 Foubert's Pl,
London W.1.

IMPORTANT—The final date of entry for the Examination is 11 May, 1961.

(A 89)

TENDERS INVITED

CITY AND COUNTY OF NEWCASTLE UPON TYNE
Transport and Electricity Undertaking

THE Transport and Electricity Committee invite tenders from manufacturers for the supply of Sodium and Colour Corrected Mercury Vapour Street Lighting Lanterns complete with control gear.

Specifications and Forms of Tender can be obtained from the undersigned, and completed tenders must be delivered in the envelope provided not later than the first post on Thursday, 23 March, 1961.

The Committee does not bind itself to accept the lowest or any tender.

F. S. TAYLOR,
General Manager.

Head Office,
Manors,
Newcastle upon Tyne 1. (A 128)

GHANA SUPPLY COMMISSION
Tender for Supply of PVC Insulated Cadmium Copper and Hard Drawn Copper Wire

THE Ghana Supply Commission invite manufacturers to apply for tender for the supply of the following:

Ref.: PAT 4082/1. Description:

(a) 66,000 yds of p.v.c. Insulated Cadmium Copper Wire.

(b) 34½ tons Bare Hard Drawn Copper Wire.

Forms of tender and conditions of contract will be obtainable from 15 March, 1961, on payment of a fee of £1, from the Secretary, Ghana Supply Commission, P.O. Box M35, Accra, Ghana.

Forms of tender will not be issued after 5 April, 1961. The closing date for receipt of tenders will be 12 April, 1961. (A 52)

COUNTY COUNCIL OF THE COUNTY OF LANARK
Trunk Roads Lighting Extensions
1. Braidwood A73
2. Muirhead A80

1 15 140 watt Sodium Discharge Lanterns, totally enclosed and suitable for housing auxiliary gear, lanterns to be supplied fitted with auxiliary gear.

2 (a). 13 Heavy type Steel Street Lighting Columns, suitable for overhead lines.

(b). 14 Steel Outreach Bracket Arms.

Tenders will be considered for the whole or any portion of the works and the County Council does not bind itself to accept the lowest or any tender.

Manufacturers desirous of tendering should make application for the tender documents to the Assistant Engineer (Lighting), 23 Beckford St, Hamilton.

Tenders will not be considered unless enclosed in a plain sealed envelope endorsed "Trunk Road Lighting" and must be delivered to the Assistant Engineer (Lighting), at the above address, not later than 10 a.m., on Friday, 24 March, 1961.

IAN V. PATERSON,
County Clerk.
(A 80)

COUNTY BOROUGH OF BLACKPOOL

TENDERS invited for the supply of the following equipment for the Lighting and Electrical Services Department.

120 Medium Class Tubular Steel Poles.
135 Fibreglass Bases and Collars for Steel Poles.
155 Group "A" Post-top Fluorescent Lanterns.
120 Cast-iron Spigots incl. Connecting Box.
165 Synchronous Solar Dial Time Switches.
32 Special Group "A" Concrete Columns.

Specification, Drawings, Tender and General Conditions from Director of Lighting and Electrical Services, Rigby Rd East, Blackpool, to be returned by 10 a.m., 20 March, 1961. (A 92)

BOLTON AND DISTRICT JOINT SEWERAGE BOARD
Ringley Fold Sewage Treatment Works

THE Board is preparing a selected list of contractors from whom tenders will be invited for the electrical work associated with the above scheme. The work will be divided into six separate contracts, namely:

1. 415 volt air break switchgear.
2. 415 volt contractor gear.
3. Works instrument panel.
4. Road and floodlighting columns and equipment.
5. Private automatic telephone exchange.
6. Main and auxiliary cables.

Firms should apply to the Board's Consulting Electrical Engineers, Messrs Kennedy and Donkin, 64 Royal Exchange, Cross St, Manchester 2, by Monday, 20 March, 1961, stating the contracts for which they wish to be considered.

PHILIP S. RENNISON,
Clerk and Solicitor to the Board.
(A 81)

METROPOLITAN BOROUGH OF WANDSWORTH
Electrical Works

APPLICATIONS invited from those who desire to have their names placed on the Council's list of electrical contractors who may be invited to submit quotations or tenders from time to time for the execution of electrical installation works.

Applications by letter giving names of two technical and one financial referee to reach me by 30 March, 1961.

J. NOEL MARTIN,
Town Clerk.

Municipal Bldgs,
Wandsworth, S.W.18. (A 79)

APPOINTMENTS VACANT

SOUTH EASTERN ELECTRICITY BOARD

DISTRICT ENGINEER
GRAVESEND DISTRICT

THE appointment will be made on Grade 3, Class G, under N.J.B. conditions, at a salary of £1,440/£1,610 per annum, with progression to Grade 2 (maximum salary: £1,720), subject to satisfactory service, plus London Allowance.

The district is predominantly industrial, but also serves a mixed urban and rural area of 37,000 consumers, and the position requires an experienced engineer, preferably corporate member of the Institution of Electrical Engineers, with ability to organise and control all aspects of the work of a distribution department.

Consideration will be given to a car allowance and assistance in house purchase in appropriate circumstances.

Applications, quoting ET and naming two referees, to District Manager, Seeboard, 17 Harmer St, Gravesend, by 22 March, 1961.

ASSISTANT DISTRICT ENGINEERS (2)
MAIDSTONE DISTRICT

Appointment No. 1. Salary: £1,040/£1,165 per annum, under N.J.B. Class F, Grade 7. Superannuable. The position requires an engineer with good technical qualifications, preferably a graduate of the Institution of Electrical Engineers. Practical experience in the construction, operation and maintenance of underground and overhead distribution systems up to 11 kV is essential.

Appointment No. 2. Salary: £890/£1,015, under N.J.B. Class F, Grade 9. Superannuable. Applicants with an adequate technical knowledge should have a good general education and have had practical experience in general distribution work on M.V. and H.V. systems.

Applications, quoting ET and naming two referees, to District Manager, Seeboard, Fairmeadow, Maidstone, by 22 March, 1961.

CARTOGRAPHER
HERNE BAY/CANTERBURY DISTRICT

Salary within range £225/£640 p.a., according to age and experience. Superannuable. Applicants should have a good general education and experience of drawing office routine.

Applications, quoting ET and naming two referees, to the Joint District Managers, Seeboard, 65 Mortimer St, Herne Bay, by 22 March, 1961.

CARTOGRAPHIC DRAUGHTSMAN
CROYDON AND PURLEY DISTRICT

Salary: £740 x £25—£815 per annum, including London Allowance, under N.J.C. Grade 2. Superannuable.

Applicants should have a good general education, experience in a distribution drawing office, and be fully conversant with mains recording and preparation of system diagrams, etc.

Applications, quoting ET and naming two referees, on forms from District Manager, Seeboard, Electric Hse, Wellesley Rd, Croydon, by 22 March, 1961.

GEORGE WRAY,
Secretary.
(A 101)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 46s. per inch, and all other classified advertisements at 3s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

SOUTH WESTERN ELECTRICITY BOARD

THIRD ASSISTANT DISTRICT ENGINEER
(OPERATION AND MAINTENANCE)
WEST CORNWALL (CAMBORNE)

SALARY within Class G, Grade 9, Salary Scale 7, £965/£1,090 per annum, of the N.J.B. Agreement.

The successful candidate will be responsible to the First Assistant District Engineer (Operation and Maintenance) and will be required to undertake general duties on the maintenance of the E.H.V., H.V. and L.V. networks and will be expected to undertake standby duties.

Previous experience and qualifications leading to the Higher National Certificate in Electrical Engineering will be an advantage and the possession of a current driving licence is desirable.

Applications to be made on Standard Form AE6/ACT, OBTAINABLE BY POST-CARD ONLY from the District Manager, South Western Electricity Board, 13 Basset Rd, Camborne. Closing date for receipt of completed applications is 25 March, 1961.

FOURTH ASSISTANT ENGINEER
(DRAWING OFFICE)
CHIEF ENGINEER'S DEPARTMENT
HEAD OFFICE, BRISTOL

Salary within Class AX, Grade 10, Salary Scale 8, £935/£1,165 per annum, of the N.J.B. Agreement.

The duties of the successful candidate will include the design and preparation of drawings in connection with outdoor switching stations at 132/33 kV Bulk Supply Points and all necessary estimates and material schedules; the design and preparation of drawings of reinforced concrete structures for this equipment; preparation of load flow, protection and system diagrams and engineering reports. He will also be required to supervise a Section in the Drawing Office and instruct apprentice engineering draughtsmen.

Applicants should be in possession of the Higher National Certificate in Electrical Engineering or equivalent qualification.

Applications to be made on Standard Form AE6/ACT, OBTAINABLE BY POST-CARD ONLY from the Establishments Officer, South Western Electricity Board, Electricity Hse, Colston Ave, Bristol 1. Closing date for receipt of completed applications is 25 March, 1961.

GENERAL ASSISTANT DISTRICT ENGINEER
(COMMERCIAL DEVELOPMENT)
BRISTOL CENTRAL (COMMERCIAL)
DISTRICT

Salary within Class K, Grade 14, Salary Scale 5, £825/£940 per annum, of the N.J.B. Agreement.

The duties associated with this position will be in connection with the development of the large commercial and industrial potential of the District. Satisfactory performance of these duties will necessitate the successful candidate possessing or acquiring a sound knowledge of electrical installations and I.E.E. and Factory Regulations; he will be required to estimate for electrical installations in factories, offices and shops, and to advise consumers on installation work, including tariffs and costs.

An engineering background is essential, and whilst commercial experience would be an advantage, consideration will be given to those engineering applicants with an aptitude for commercial work but without actual commercial experience.

Possession of appropriate technical qualifications at least equivalent to the Ordinary National Certificate in Electrical Engineering is desirable.

Applications to be made on Standard Form AE6/ACT, OBTAINABLE BY POST-CARD ONLY from the Manager, Bristol Central (Commercial) District, South Western Electricity Board, Electricity Hse, Colston Ave, Bristol 1. Closing date for receipt of completed applications is 25 March, 1961.

GENERAL ASSISTANT DISTRICT
COMMERCIAL ENGINEER
BRISTOL EAST (COMMERCIAL) DISTRICT

Salary within Class K, Grade 14, Salary

continued in next column

continued from previous column

Scale 5, £825/£940 per annum, of the N.J.B. Agreement.

The successful candidate's duties will be concerned with the development of the industrial, commercial and domestic potential of the District.

This will include the preparation of plans and estimates for electrical installations in all types of premises with particular reference to space and storage heating systems. This will entail liaison with sales representatives and advising consumers on installation costs and tariffs.

An engineering background is desirable and candidates must have experience of electrical installation work, and a sound knowledge of Factories Acts, and I.E.E. and similar Regulations. Whilst a commercial background would be an advantage, consideration will be given to those applicants with practical experience and an aptitude for commercial work.

Possession of appropriate technical qualifications at least equivalent to the Ordinary National Certificate in Electrical Engineering is desirable.

Applications to be made on Standard Form AE6/ACT, OBTAINABLE BY POST-CARD ONLY from the Manager, Bristol East (Commercial) District, South Western Electricity Board, 70 Overnhill Rd, Downend, Bristol. Closing date for receipt of completed applications is 25 March, 1961.
(A 104)

THE SOUTH WALES ELECTRICITY BOARD

ASSISTANT ENGINEER

APPLICATIONS are invited for the position of Assistant Engineer in the Pembrokeshire District (Tenby) in the West Wales Area.

Preference will be given to Engineers possessing the Higher National Certificate in Electrical Engineering.

Salary: N.J.B. Class E, Grade 9, Scale 5, £825/£940 per annum. (It is expected that the classification will shortly be raised to "F.")

Applications stating age, present position, present salary, qualifications and experience should be addressed to the Manager, West Wales Area, South Beach Pavilion, Tenby, Pembs, to arrive not later than 30 March, 1961.

Please quote reference 26/61/ET endorsing envelope "Assistant Engineer."

R. G. WILLIAMS,
Secretary.
(A 99)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

ELECTRICAL ENGINEER'S DEPARTMENT
NORTHFLEET DISTRICT
Vacancy No. 82/61.
THIRD ASSISTANT ENGINEER

REQUIRED to be responsible for records, allocation of transport, operation of a job card system and detailed planning of stores and material to facilitate the work of construction, operation and maintenance of overhead lines and substations operating at 132 kV and 275 kV within the Northfleet District. Possession of H.N.C. (Electrical or Mechanical) or equivalent qualification and previous experience of work on the transmission system are desirable.

Salary within Class AX, Grade 8, £1,155/£1,375 per annum including London Allowance.

Applications giving age, details of qualifications, experience, etc., should be sent to the Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kington upon Thames, Surrey, to arrive by 23 March.
(A 98)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

SHIFT CHARGE ENGINEER
LEICESTER POWER STATION
Vacancy No. 34/61.

APPLICATIONS are invited for the position of Shift Charge Engineer at Leicester Power Station, Rawdykes Rd, Leicester.

Applicants should preferably hold a Higher National Certificate and have had experience in a modern P.F. fired station.

Salary will be in accordance with Class G, Grade 7 (£1,115/£1,245 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 17 March, 1961.

ASSISTANT PLANNING ENGINEER
CASTLE DONINGTON POWER STATION
Vacancy No. 39/61.

Applications are invited for the position of Assistant Planning Engineer at Castle Donington Power Station, near Derby.

Applicants should have received a sound theoretical and practical training in Engineering, have experience on high merit Plant and should have a clear and objective approach to power station planning problems.

Qualifications leading to Corporate Membership of a senior engineering institution are desirable.

Salary will be in accordance with Class L, Grade 8 (£1,350/£1,500 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 24 March, 1961.

ASSISTANT EFFICIENCY ENGINEER
CASTLE DONINGTON POWER STATION
Vacancy No. 40/61.

Applications are invited for the position of Assistant Efficiency Engineer at Castle Donington Power Station, near Derby.

Applicants should have received a sound theoretical and practical training in Engineering. Experience in testing large high merit Plant would be an advantage.

Qualifications leading to Corporate Membership of a senior engineering institution are desirable.

Salary will be in accordance with Class L, Grade 8 (£1,350/£1,500 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 24 March, 1961.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent and should be returned to him by the date stated.

O. S. WOODS,
Divisional Controller.
(A 103)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

APPLICATIONS are invited for the position of

EFFICIENCY ENGINEER

at Rugeley Power Station. Salary in accordance with Class L, Grade 6 (£1,535/£1,720 per annum) of the National Joint Board Agreement.

Applicants should have held a position of responsibility in a modern Power Station and should have had a thorough practical and theoretical training. Preference will be given to candidates who are Associate Members of the Institution of Mechanical or Electrical Engineers or hold qualifications leading to associate membership, and who have had experience of plant efficiency control and routine testing procedures.

Apply, quoting vacancy no. 48/61MD, on Form AE6, available from the Station Superintendent, Rugeley Power Station, Rugeley, Staffs. Closing date for receipt of applications: 20 March, 1961. (A 113)

THE NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified engineers for the following appointments which are subject to the conditions of the National Joint Board.

Wear Sub-Area

SENIOR ASSISTANT ENGINEER
SUB-AREA COMMERCIAL OFFICER'S STAFF
INDUSTRIAL SECTION
WITH LOCATION AT SUB-AREA
HEADQUARTERS, SUNDERLAND

Applicants should have a sound knowledge of the general uses of electric power and heat in industry and a wide experience of negotiations with all types of industrial consumers.

Salary: Schedule A, Class L, Grade 4, £1,795/£1,950 per annum.

Tees Sub-Area

FOURTH ASSISTANT ENGINEER
(ASSISTANT CLERK OF WORKS/BUILDINGS)
WITH LOCATION AT SUB-AREA
HEADQUARTERS, THORNABY

Duties include supervision of the construction and maintenance of the Board's property, comprising substations, workshops, depots, service centres and offices. Applicants should be familiar with bills of quantities and be able to set out, measure up and deal with interim and final accounts.

Salary: Schedule A, Class L, Grade 13, £965/£1,090 per annum.

York Sub-Area

YORK DISTRICT
FIRST ASSISTANT DISTRICT ENGINEER

Applicants should have experience in the operation of H.V. and L.V. urban and rural overhead and underground distribution systems.

Salary: Schedule A, Class G, Grade 4, £1,350/£1,500 per annum.

Applications, stating age, qualifications and experience, to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne 1, within ten days of the appearance of this advertisement. (A 108)

EASTERN ELECTRICITY BOARD

Northmet Sub-Area

GENERAL ASSISTANT ENGINEERS
(OPERATION AND MAINTENANCE)
SUB-AREA ENGINEER'S DEPARTMENT
(Ref. 969)
43/61.N.

ENGINEERS are required for general duties including the commissioning and testing of protective gear, automatic control and communication equipment. Candidates who lack specialist experience but who have a good technical background will be considered.

Salary: N.J.B. Class N, Grade 14 (£1,090/£1,215) inclusive of London Allowance.

Apply by letter to the Manager, Eastern Electricity Board, Northmet Sub-Area, Northmet Hse, Southgate, London N.14, by 20 March, 1961. (A 97)

DOLGARROG HYDRO-ELECTRIC POWER STATION

OPERATION SUPERINTENDENT

This is the senior post at a 28 MW station on the banks of the River Conway, North Wales, where the successful candidate will be responsible to the Station Superintendent of a Group for efficient management, running, maintenance etc. A sound practical and theoretical engineering training is required and possession of appropriate technical qualifications an advantage. Salary within range £1,115/£1,245 (E.5). Superannuable. Previous applicants need not re-apply. Write giving full details and quoting names of two referees to Director of Labour and Welfare, CENTRAL ELECTRICITY GENERATING BOARD, 825 Wilmslow Road, Manchester 20, by 17th March, 1961. Please quote vacancy No. E.68/52/T.

(A 118)

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

Vacancy No. ET/AV/27/61.
THIRD ASSISTANT ENGINEER

REQUIRED in the Taunton District of the Divisional Electrical Department.

Superannuation Scheme. Salary: N.J.B. Class AX, Grade 8, Scale 10, £1,105/£1,325 per annum.

Applicants, who should be Graduate Members of the Institution of Electrical Engineers, must have experience of the commissioning of all types of electrical plant and equipment for operation in power stations and 132/275 kV transmission substations together with a full appreciation of the maintenance services required by such equipment.

Previous applicants need not re-apply.

Applications on form AE6/ACT obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 20 March, 1961. (A 100)

THE EAST MIDLANDS ELECTRICITY BOARD

Lincolnshire Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER
LINCOLN DISTRICT
Vacancy No. 28/61.

SALARY: N.J.B. Class F, Grade 9, £890/£1,015 per annum. There is a possibility that the Lincoln District will be reclassified to Class G from 1 April, 1961.

The duties of the post will be to assist in the planning, construction, operation and maintenance of underground and overhead systems up to and including 11 kV.

The successful candidate will be required to reside in or near the City of Lincoln and to undertake standby duty.

Applications should be forwarded to the Manager, Lincoln District, Brayford Side North, Lincoln, witin 14 days of the date of this advertisement. (A 102)

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Division

TRANSMISSION DEPARTMENT
CHARGEHAND LINESMAN
(NORTON SECTION)

A CHARGEHAND LINESMAN is required for the Norton Section of the Transmission Department with Headquarters at Letch La, Carlton, Stockton-on-Tees.

Applicants should have had a wide experience in maintenance and/or erection of overhead lines on lattice steel towers up to and including 275 kV.

Conditions of employment will be in accordance with the National Joint Industrial Council Agreement for the Electricity Supply Industry, the present rate of pay being 5s 6½d per hour, plus 6½d per hour Chargehand Allowance per week of 42 hours.

Applications, stating age and giving full details of experience, should be sent to the Divisional Administrative Officer, Central Electricity Generating Board, North Eastern Division, Carliol Hse, Newcastle upon Tyne 1, to arrive not later than 24 March, 1961. (A 82)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

Headquarters

SECOND ASSISTANT ENGINEER
(CONSTRUCTION)

REQUIRED in the Chief Engineer's Department at Board Headquarters, Love La, Pall Mall, Liverpool 3. Salary within range £1,375/£1,610 per annum (N.J.B. AX/5) with an initial placing according to qualifications and experience.

Duties will include the preparation of specifications for substation plant, design of indoor and outdoor substations operating at voltages up to and including 33 kV.

Applicants should have a sound general knowledge of substation plant and be technically qualified. Some experience of field construction would be advantageous.

Appointment subject to medical examination. Pension Scheme.

Application forms, obtainable from the Assistant Establishments Officer at the above address, should be returned not later than 4 April, 1961. (A 105)

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

FOURTH ASSISTANT ENGINEER
(OPERATION AND MAINTENANCE)

APPLICANTS should have had experience in the operation of high-voltage systems. The successful candidate will be required to take part in a rota of shift duties covering the Sheffield City network.

Salary: N.J.B. Class N, Grade 13 (Scale 9) plus 10% shift enhancement £1,226 10s/£1,369 10s per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield 1, not later than 24 March, 1961.

No. 7 (Grimsby) Sub-Area

GRIMSBY DISTRICT
THIRD ASSISTANT DISTRICT ENGINEER

Applicants should be of Higher National Certificate Standard in Electrical Engineering and have experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and ancillary equipment.

Salary: N.J.B. Class H, Grade 9, Scale 8, £1,040 x £25—£1,165 per annum.

GAINSBOROUGH DISTRICT
SECOND ASSISTANT DISTRICT ENGINEER

Applicants should preferably be Corporate Members of the Institution of Electrical Engineers or hold an equivalent qualification. They must have had a sound training and extensive experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems in rural and urban areas, substation plant and ancillary equipment.

Salary: N.J.B. Class E, Grade 7 (Scale 7), £965 x £25—£1,090 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 24 March, 1961. (A 107)

THE EAST MIDLANDS ELECTRICITY BOARD

Nottingham Sub-Area

CABLE JOINTERS

APPLICANTS should be fully trained on all forms of jointing, including plumbing, on medium voltage and E.H.V. systems. Rate: 5s 4½d and 5s 6½d per hour, respectively.

ELECTRICAL FITTERS

Applicants should preferably have served an appropriate apprenticeship and be fully trained in fitting work. Experience on the erection and maintenance of H.V. and L.V. switch and fuse gear, and other substation equipment, would be an advantage. Rate: 5s 6½d per hour.

Both the above vacancies are for a 42-hour five-day week, under N.J.I.C. conditions of service.

Applications in writing, stating age, experience and present employment to The Manager, Nottingham Sub-Area, The East Midlands Electricity Board, Carrington St, Nottingham, within 14 days of this advertisement. (A 95)

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS are invited for the following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

STATION SHIFT CONTROL ENGINEER
BLACKWALL POINT POWER STATION
Vacancy No. 61/127.

Sound technical training necessary with experience in control and operation of modern generating plant and E.H.T. switchgear. Salary: Class G, Grade 10, £940/£1,065, plus £90/£101 10s shift per annum.

Applications, quoting vacancy number to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box 136, London W.1, by 21 March, 1961. (A 91)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT CONSUMERS' ENGINEER (1)

REQUIRED in the Liverpool North District of the Board's No. 1 Sub-Area. Salary within range £965/£1,090 per annum (N.J.B. J/11).

Duties will include estimating and preparation of specifications for contracting work, and advising consumers on matters relating to electricity supply and the utilisation of electrical equipment. Possession of suitable technical qualifications will be advantageous.

Appointment subject to medical examination. Pension Scheme.

Standard application forms should be forwarded to the Manager, No. 1 Sub-Area, 24 Hatton Gdn, Liverpool 3, not later than the 23 March, 1961. (A 106)

SOUTHERN ELECTRICITY BOARD

FIELD ENGINEER (CONSTRUCTION)

SUB-AREA Engineering Department of No. 3 (Portsmouth) Sub-Area. Salary: N.J.B. Class L, Grade 13 (£965/£1,090 per annum). N.J.B. Conditions of Service.

The duties of the post will be to carry out site supervision, installation and erection of plant, equipment and overhead lines, the laying of cables and other constructional work on all distribution systems up to and including 33 kV.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting Z.1312, not later than 20 March, 1961. (A 109)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. Schedule A appointments in the South Wales Division.

ASSISTANT SHIFT CHARGE ENGINEER
USKMOUTH "A" POWER STATION
WEST NASH, Nr. NEWPORT, MON
Vacancy No. 43/ET/61.

Salary: Class K, Grade 8, Scale 11, £1,275/£1,410 per annum.

STATION SHIFT CONTROL ENGINEER
UPPER BOAT POWER STATION
Nr. PONTYPRIDD, GLAM
Vacancy No. 44/ET/61.

Salary: Class H, Grade 10, Scale 7, £965/£1,090 per annum.

STATION SHIFT CONTROL ENGINEER
ABERTHAW POWER STATION
THE LEYS, Nr. BARRY, GLAM
Vacancy No. 45/ET/61.

Salary: Class L, Grade 10, Scale 10, £1,190/£1,325 per annum.

Applicants for the above posts should possess H.N.C. or equivalent qualifications and have had operating experience in a modern power station.

Ten per cent shift allowance payable in all cases.

Special application forms obtainable from Divisional Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 25 March, 1961. (A 96)

LONDON ELECTRICITY BOARD

ASSISTANT DISTRIBUTION ENGINEERS

VACANCIES for Assistant Distribution Engineers exist in the undernoted Districts. Applications stating age, qualifications and experience should be sent direct to the Manager of the District concerned, quoting the appropriate reference number.

Applicants should have a sound technical education to the standard of the Higher National Certificate and possess practical experience of all branches of engineering work associated with the organisation of a District distribution department.

The posts are graded under Schedule A of the National Joint Board Agreement as Class H. The salary figures quoted are inclusive of London Allowance.

EAST END DISTRICT
255-279 CAMBRIDGE HEATH RD, E.2
(Ref.: PER/V/3197/T.)
Salary: Grade 9, £1,090/£1,215 per annum.

WESTERN DISTRICT
154 UXBRIDGE RD, W.12
(Ref.: PER/V/3223/T.)
Salary: Grade 9, £1,090/£1,215 per annum.

BOROUGH DISTRICT
15 PENROSE ST, S.E.17
(Ref.: PER/V/3203/T.)
Salary: Grade 11, £940/£1,065 per annum.

SOUTH EASTERN DISTRICT
44 POWIS ST, S.E.18.
(Ref.: PER/V/3206/T.)
Salary: Grade 11, £940/£1,065 per annum.
(A 94)

J. & P.

SENIOR APPOINTMENTS WITH ELECTRICAL MANUFACTURING COMPANY IN CALCUTTA

SALES MANAGER

Due to expansion it is proposed to appoint a Sales Manager in the switchgear and motor manufacturing division of a Company in Calcutta.

Applications are invited from persons having technical qualifications and experience in these or similar products. There are opportunities for considerable extension of the business and of personal advancement.

MANAGER for SWITCHGEAR DEPARTMENT

A switchgear engineer is required to be responsible for the technical and production control of the Switchgear Department of the factory in Calcutta producing industrial switchgear up to 11 kV. This is a responsible and permanent appointment with good prospects of advancement. Extensive factory expansion is programmed.

If you are interested in either of the above appointments, you are invited to send details of your qualifications, experience and present salary, in confidence, to the Director and General Manager, Johnson and Phillips Ltd., Charlton, London S.E.7.

(A 120)

Training for engineers in the Electricity Supply Industry

The Electricity Supply Industry employs 18,000 electrical and mechanical engineers in all parts of England and Wales. They are responsible for generating electricity in the power stations, transmitting it over the Grid, and distributing it throughout the country. To keep this key force up to strength as older staff retire and sales of power rise, the industry needs each year to recruit several hundred young men to its technical training schemes.

Five-year apprenticeships are available to school-leavers who hold a good Ordinary level G.C.E., including maths. and a science, or two Advanced level passes in maths. and physics. Training is by means of planned practical experience, combined with day or "sandwich" release leading to an engineering qualification.

Two-year traineeships are offered to graduates holding a degree in electrical or mechanical engineering from a British university. Training provides extensive and varied practical experience and satisfies the requirement of the professional institutions.

Those who already possess an engineering Diploma may also be considered for practical training. This will be planned according to the previous experience of the trainee.

On satisfactory completion of training, all apprentices and trainees are guaranteed employment in this essential and expanding industry. A wide range of careers is available, in many types of engineering, including research and commercial development.

For further information write to:
The Education and Training Officer,
The Electricity Council, 13 Winsley Street, London, W.1.

A 126

ELECTRICAL DRAUGHTSMAN AND ESTIMATOR/DRAUGHTSMAN

required by

J. LYONS & COMPANY LIMITED

(Ice Cream Division)

A vacancy exists for a Senior Electrical Draughtsman required to have experience on General Distribution, Lighting, Motor Controls, Process and Sequence Controls associated with Automation. Some knowledge of Electronics would be an advantage.

A vacancy exists for Senior Electrical Estimator/Draughtsman required to have experience of Estimating for Electrical Contracting Installations, based on General Distribution Lighting, Motor Controls, Process and Sequence Controls. This will involve a certain amount of preparation of drawings to be used as a basis of estimates. H.N.C. desirable.

An attractive salary will be paid to the right men and the appointment offers good prospects for further advancement.

The Company offers good conditions of service and a Contributory Pension Scheme.

Holiday arrangements honoured.

Applications will be treated in the strictest confidence and should be made in writing to:

The Personnel Manager,
Lyons Maid House,
Hammersmith Grove,
London W.6.

(A 51)

'ELECTRICIANS'

Fully qualified electricians required for general maintenance and installation work on large integrated Iron and Steel Works. Excellent conditions, pension scheme in operation. Apply to: The Employment Officer, Appleby-Frodingham Steel Co., Scunthorpe, Lincs. (A 115)

MEM

Applications are invited for appointment to our sales staff as representative operating within the South Eastern Electricity Board area. The position offers excellent opportunities for the right man—it is pensionable and a motor car is provided. Please apply in writing to General Sales Manager, Midland Electric Manufacturing Co. Ltd., Reddings La, Tyseley, Birmingham 11.

(A 20)

TECHNICAL ASSISTANT

A young Electrical Engineer with H.N.C. is required for the testing of large high voltage power transformers and auxiliary equipment.

The work will be mainly concerned with Impulse and High Voltage Testing and special tests such as noise measurement. Experience in these particular fields is not essential, adequate training will be given.

Good commencing salary and conditions of service will be offered.

Apply: Personnel Manager, Fuller Electric Ltd., Fulbourne Rd, Walthamstow, E.17.

(A 121)

ELECTRICAL ENGINEERS INSTALLATION DESIGN WORK

Engineers wanted by Consulting Engineers with expanding practice for Croydon office. Salary up to £1,100 p.a. governed by qualifications and experience. Good prospects.

Write giving details of experience to Barlow, Leslie and Coombes, 119-121 High St, Croydon.

(A 119)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY

ELECTRICAL ENGINEER

required at Dounreay Experimental Reactor Establishment, Thurso, Caithness, Scotland, to be responsible for the installation and maintenance of electrical plant associated with Reactors and Chemical Plant.

Applicants must have served a recognised engineering apprenticeship or pupilage and be at least Graduate I.E.E. or have equivalent qualifications.

Salary from £1,005 (at age 25) to £1,535 according to age and experience.

Rented housing and house purchase assistance available for married officers living beyond daily travelling distance. Hostel accommodation available. Contributory superannuation.

Send postcard for application form to Personnel Manager at above address, quoting reference 202/49.

(A 90)

J. & P.

Staff required in

OVERSEAS DEPARTMENT

(1) TECHNICAL SALES. Man aged 30-40 years qualified to H.N.C. Standard Electrical Engineering, previous commercial experience preferred, but not essential.

(2) EXPORT DOCUMENTATION CLERK (male or female), aged 25-35 years, preferably with previous experience of Bills of Exchange, Letters of Credit, etc.

(3) CABLE ESTIMATOR (male), aged 25-40 years, preferably with previous experience of handling overseas customers' inquiries and orders.

Applications stating age and experience to: The Employment Manager, Johnson and Phillips Ltd., Charlton, S.E.7.

(A 88)

ALUMINIUM LABORATORIES LIMITED

(The Research and Technical Organisation of the international ALCAN Group of Companies)

An ELECTRICAL ENGINEER is required to work on experimental insulated aluminium cables. Applicants should have experience in the design, testing and manufacture of insulated power cables and should have suitable academic qualifications. Pension and Life Assurance Scheme in operation. Please apply to:

Personnel Officer,
Aluminium Laboratories Ltd.,
Banbury, Oxon.

(A 26)

ELECTRICAL ACCESSORIES REPRESENTATIVE

required for Scotland with a knowledge and connection within the Electrical Industry. Excellent opportunity for the right person together with a Pension Scheme, car, etc. S. O. Bowker Ltd. (Tenby), 19-21 Warstone La, Birmingham 18. (A 129)

BRITISH RAILWAYS

Eastern Region Electrified Lines LONDON AREA

ASSISTANT CONTROL ROOM OPERATORS

required

under Railway Electrical Conditions to assist in the operation of the Electrical Control Room at Romford, Essex. Applicants should have served a recognised apprenticeship and possess knowledge of E.H.T. and L.T. Distribution Systems, Isolation Procedure and Safety Precautions. Shift working involved. Rate of pay £12 2s per week of 44 hours, plus Shift Allowance 33s. Enhanced pay for overtime and Sunday duty. Applicants required to undergo medical examination. Certain free and reduced rate rail travel facilities. Pension and Sick Pay Scheme. Prospects of promotion. Apply in writing giving age, apprenticeship and experience to the Electric Traction Engineer (London Area), British Railways, Eastern Region, off Ley St, Ilford, Essex.

(A 122)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division
ASSISTANT ENGINEERS

ARE required at Ironbridge Power Station. N.J.B. service conditions, superannuable appointment. Salary within Schedule A, Grade J.12, £890/£1,015 per annum. These engineers will be expected to carry out shift relief duties and when not so employed will be available to undertake duties in the maintenance and operation departments. Shift allowance as laid down in the N.J.B. Agreement will be paid when shift duties are worked.

Applicants should have received a sound technical training and should preferably have had experience in the control of a works supply system. Appropriate technical qualifications will be an advantage.

Apply, quoting vacancy no. 44/61MD, on form AE6, available from the Station Superintendent, Ironbridge Power Station, Buildwas, Salop, to whom they should be returned when completed not later than 20 March, 1961. (A 111)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division

APPLICATIONS are invited for two positions of
ASSISTANT ENGINEER (OPERATION)
at Rugeley Power Station. Salary will be in accordance with Class L, Grade 10, £1,190/£1,325 per annum, of the National Joint Board Agreement.

Applicants should possess a Higher National Certificate or equivalent qualifications and have had operation experience in a modern Power Station. Experience of pulverised fuel firing would be an advantage. The successful applicants will be required to act as reliefs for Assistant Shift Charge Engineers and will then be entitled to the appropriate grade and shift enhancement.

Apply, quoting vacancy no. 49/61 MD on form AE6, available from the Station Superintendent, Rugeley Power Station, Rugeley, Staffs. Closing date for receipt of applications: 20 March, 1961. (A 114)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division
GENERAL ASSISTANT ENGINEER

REQUIRED at Ironbridge Power Station for generation operational duties. N.J.B. service conditions, superannuable appointment, salary within Schedule A, J14, £765/£870 per annum, a shift enhancement of £90 will be paid when engaged on shift duties.

Applicants should have received a sound technical training and preferably have had some industrial engineering experience, and have as a minimum qualification the Ordinary National Certificate.

Apply, quoting Vacancy No. 43/61 MD on form AE6 available from the Station Superintendent, Ironbridge Power Station, Buildwas, Salop, to whom they should be returned when completed not later than 20 March, 1961. (A 110)

CENTRAL ELECTRICITY GENERATING BOARD
Eastern Division

APPLICATIONS are invited for the following appointment at WEST THURROCK GENERATING STATION (ESSEX):
MAINTENANCE ENGINEER (INSTRUMENTS)
(S.V. No. 1452)

Salary range: £1,595/£1,780 per annum, inclusive of London Weighting.

Applicants should have had a wide experience in instrument maintenance and a sound working knowledge of industrial electronics.

Corporate membership of a recognised engineering or electronic institution would be an advantage.

Applications, quoting reference S.V. No. 1452, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, to arrive not later than 18 March, 1961. (A 83)

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Apply, quoting vacancy no. 45/61MD, on form AE6, available from the System Operation Engineer, Warwick Hse, Redhill Rd, West Heath, Birmingham 31. Closing date for receipt of applications: 20 March, 1961. (A 112)

WEST SUFFOLK COUNTY COUNCIL
County Architect's Department

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on APT Grade IV (£1,140/£1,310); commencing salary in accordance with qualifications and experience.

Applicants should hold a university degree or equivalent diploma in electrical engineering or be Associate Members of the Institution of Electrical Engineers, with experience in the design and supervision of electrical lighting and power installations.

Housing accommodation may be made available.

N.J.C. Service Conditions; post pensionable, medical examination.

Application forms obtainable from the County Architect, 13 Westgate St, Bury St. Edmunds, to be returned as soon as possible. (A 93)

CABLE ESTIMATOR (male), aged 25-40 years, preferably with previous experience of handling overseas customers' inquiries and orders.

Applications stating age and experience to: The Employment Manager, Johnson and Phillips Ltd., Charlton, S.E.7. (A 86)

CABLE manufacturers require first-class REPRESENTATIVES for the London and South Eastern Counties. Experienced men, with the desire and ability to take over senior positions, should submit fullest details in their first application to Box No. 8223, Electrical Times. (A 87)

CABLING JOINTER wanted, capable of jointing up to and including 11 kV cables. Must be willing to travel anywhere in the Midlands, Lincolnshire and Lancashire areas. Must be able to drive. Excellent rates of pay and working conditions.—Box 8225, Electrical Times. (A 123)

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Applications stating age and experience to: The Employment Manager, Johnson and Phillips Ltd., Charlton, S.E.7. (A 85)

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Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House' Sardinia Street, London, W.C.2

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An intimate knowledge of the rates of pay and conditions of working applicable to the appropriate trades essential. Permanent superannuated post. Write stating age and details of previous experience to Box No. 8215, Electrical Times. (A 28)

OVERHEAD LINE ENGINEER required by Consulting Engineers in their Head Office. Experience required in Design and Contract work of tower and wood pole lines. Applications stating age, qualifications, experience and salary required to Kennedy and Donkin, 12 Caxton St, London S.W.1, quoting Ref. JGW/HSJ. (A 35)

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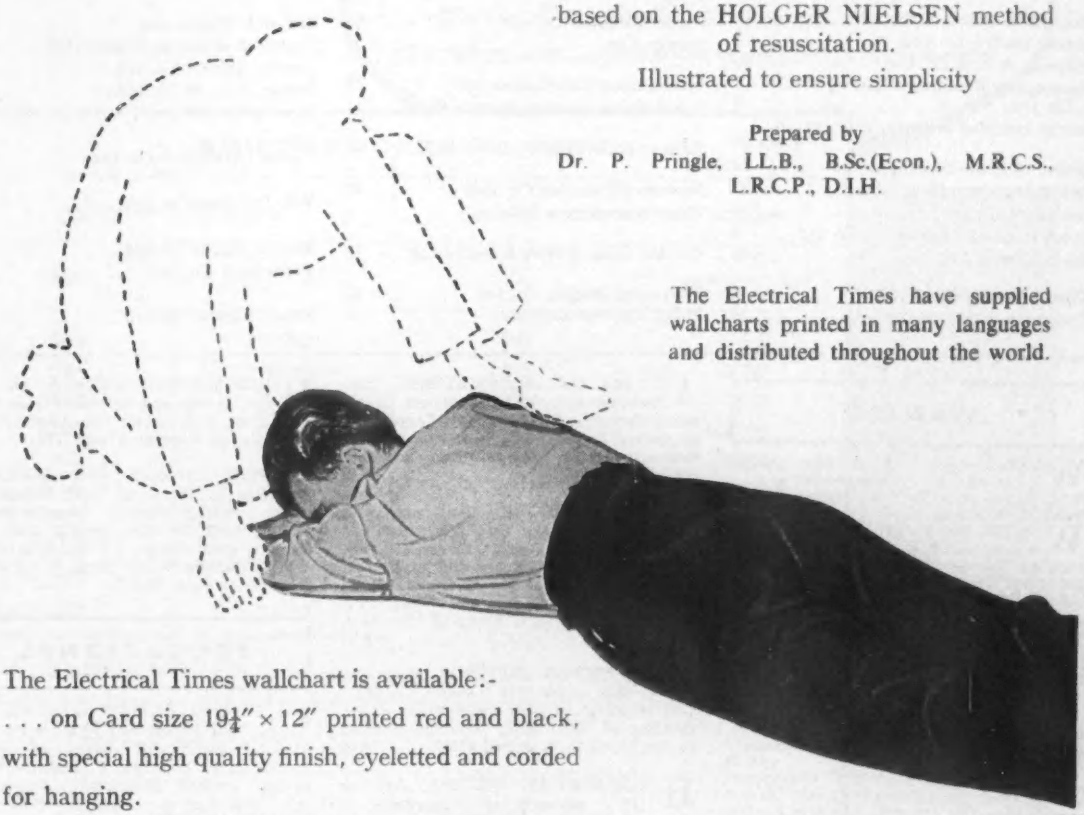

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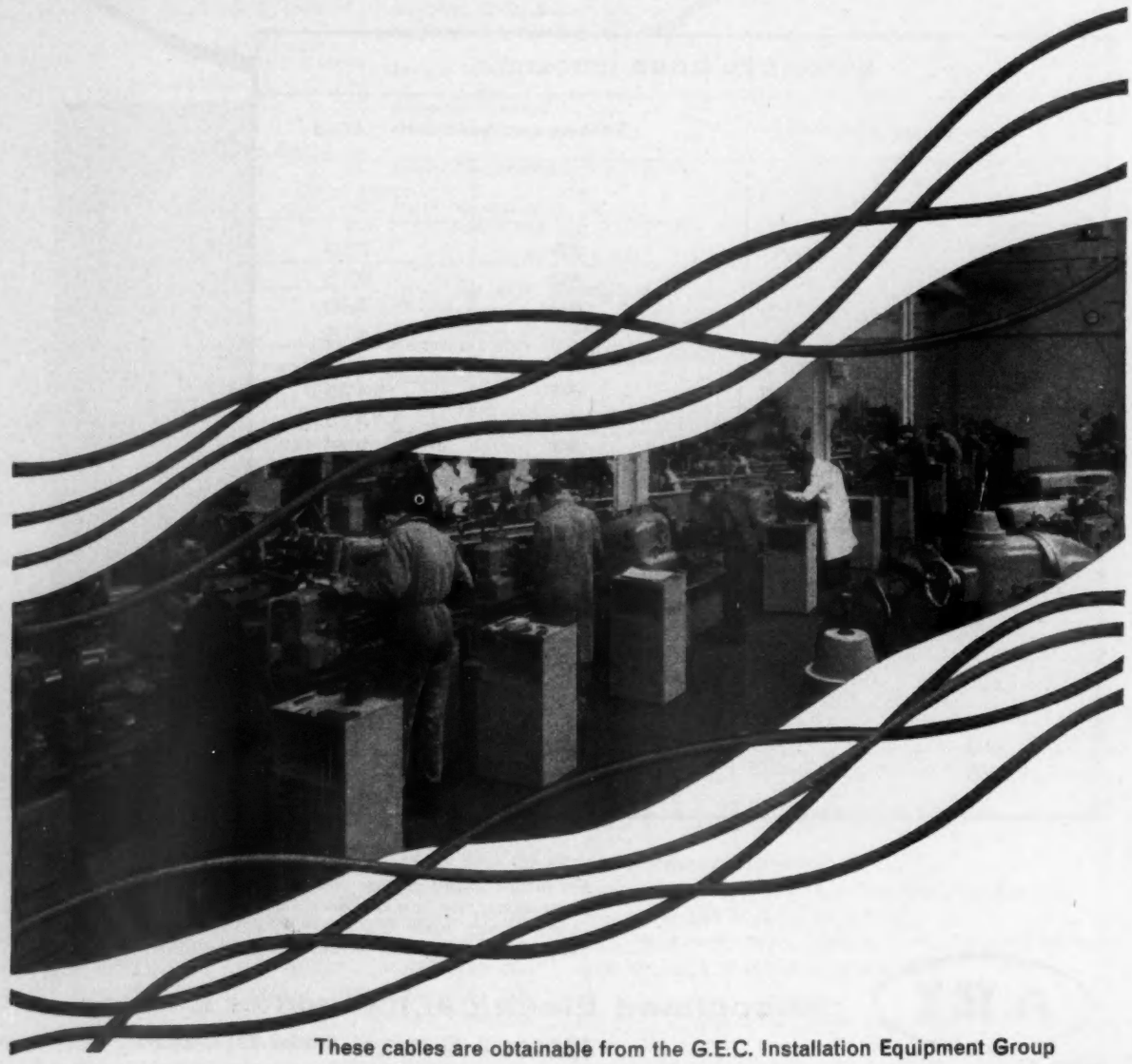

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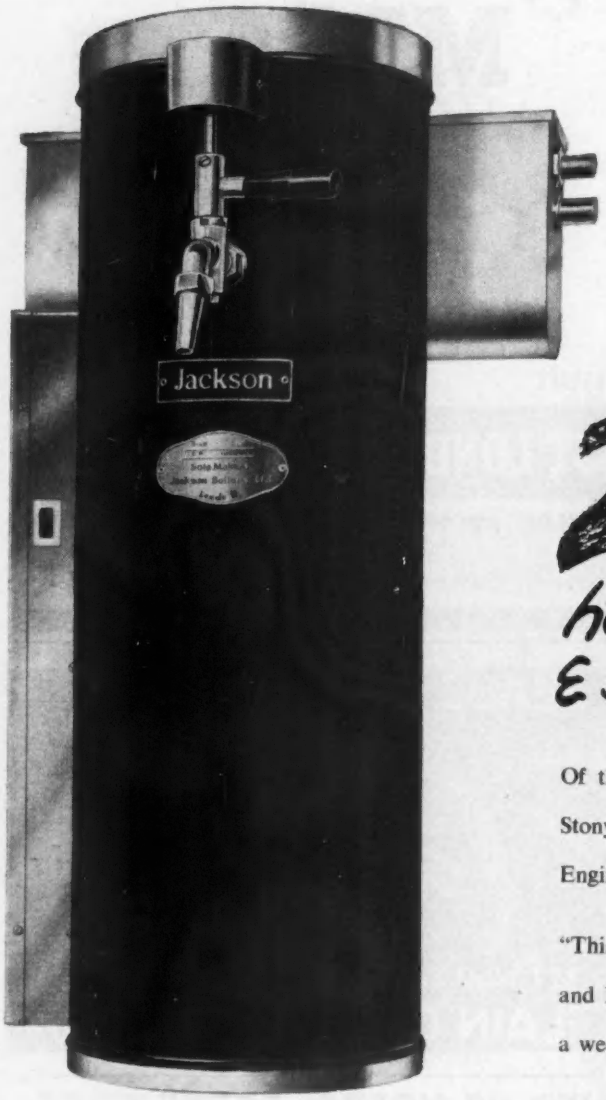

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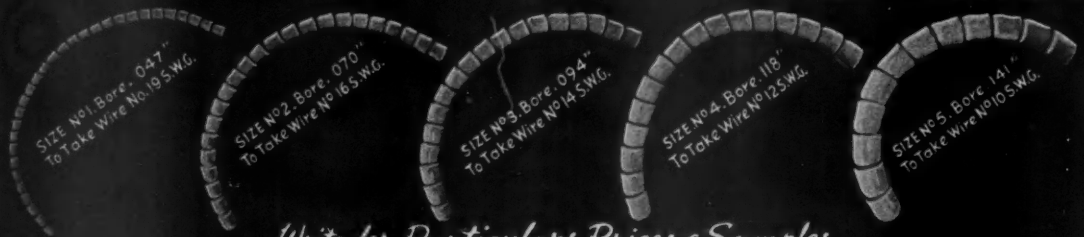
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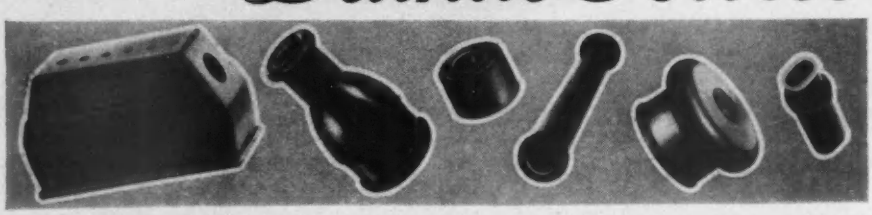

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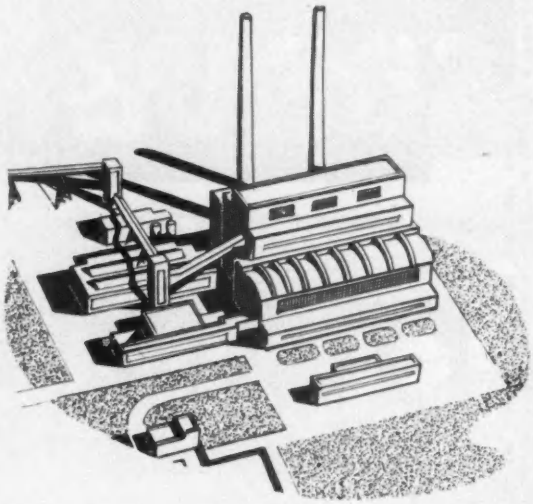

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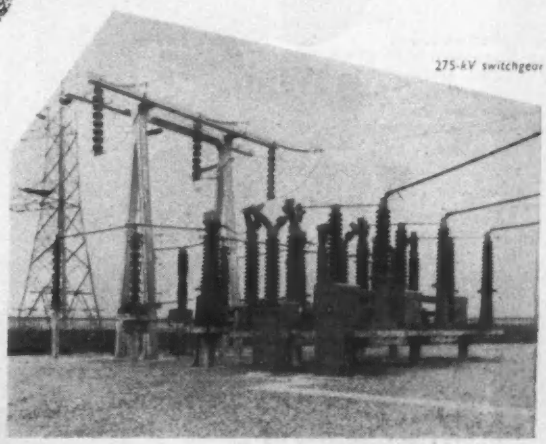

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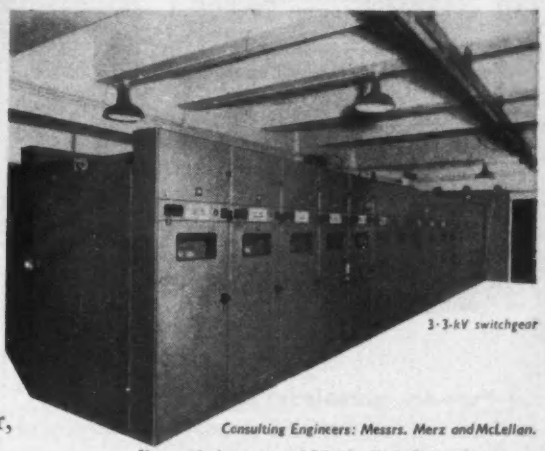

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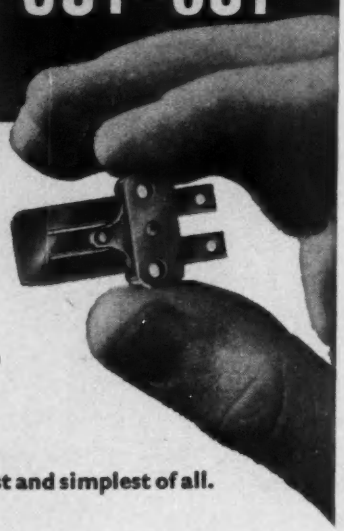

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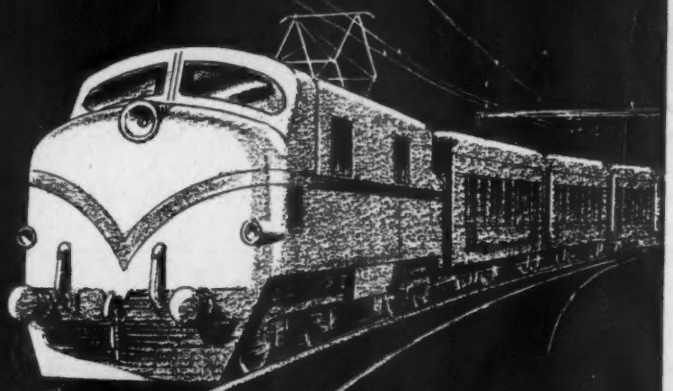

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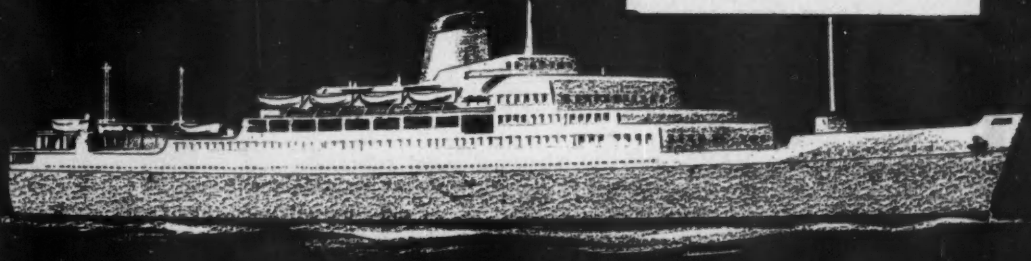

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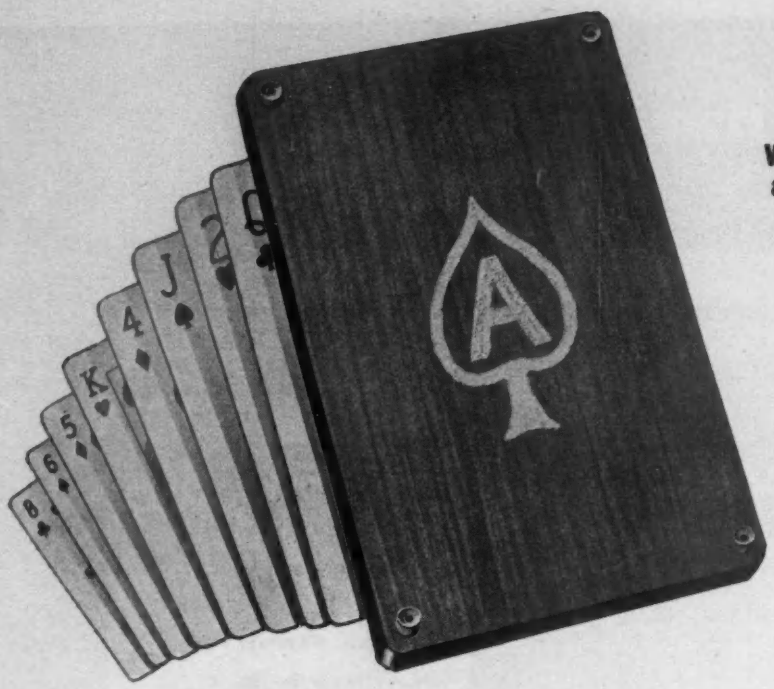

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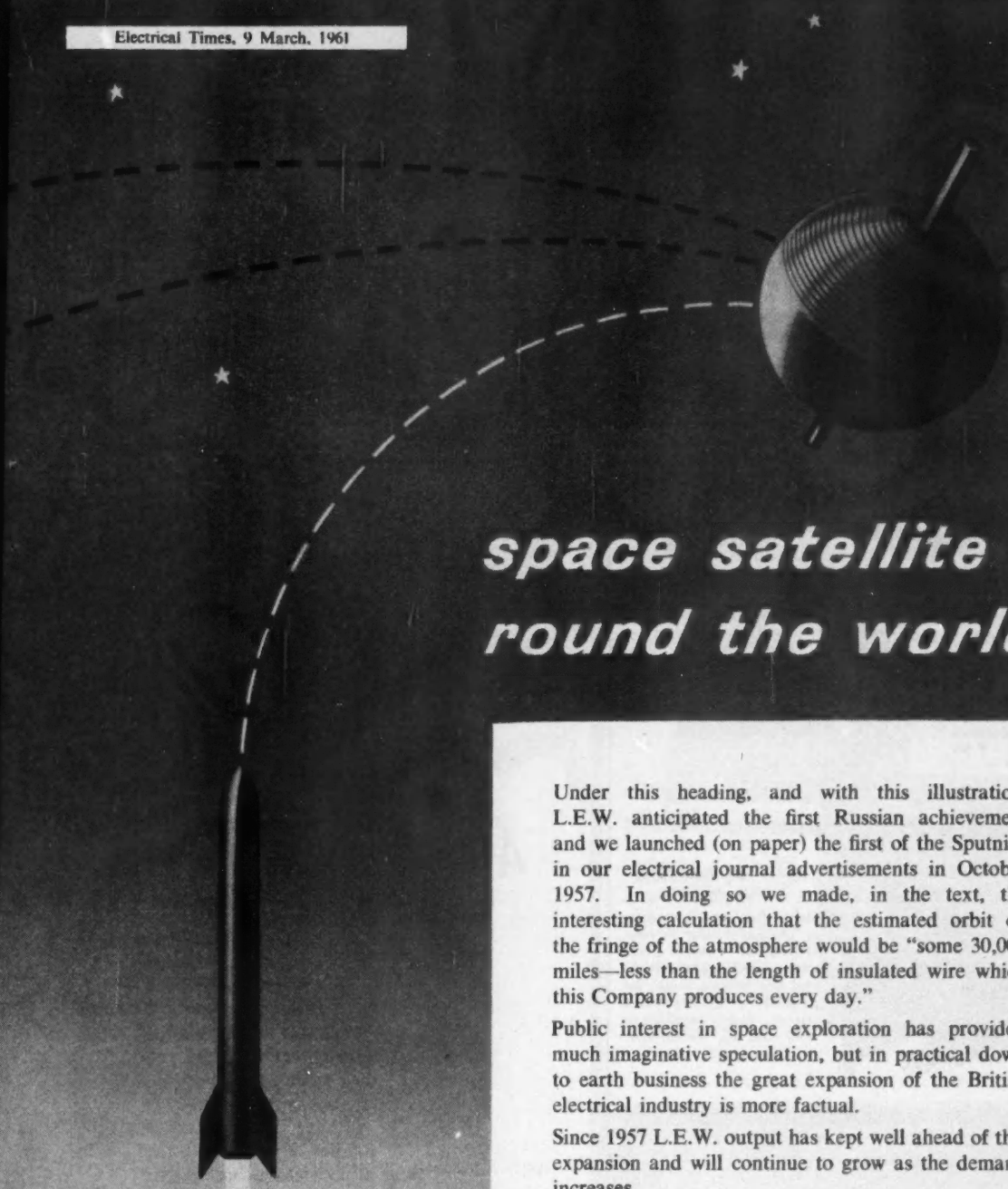

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Under this heading, and with this illustration, L.E.W. anticipated the first Russian achievement and we launched (on paper) the first of the Sputniks in our electrical journal advertisements in October 1957. In doing so we made, in the text, the interesting calculation that the estimated orbit on the fringe of the atmosphere would be "some 30,000 miles—less than the length of insulated wire which this Company produces every day."

Public interest in space exploration has provided much imaginative speculation, but in practical down to earth business the great expansion of the British electrical industry is more factual.

Since 1957 L.E.W. output has kept well ahead of this expansion and will continue to grow as the demand increases.

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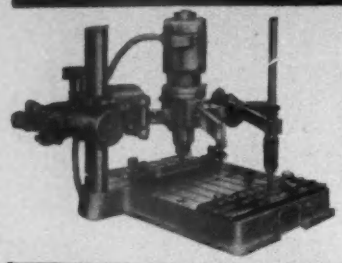

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£95 Complete ready for use

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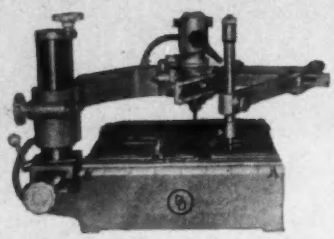

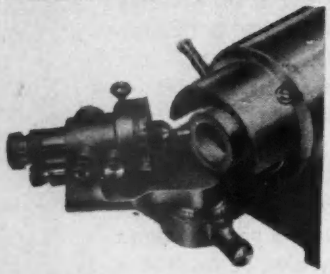

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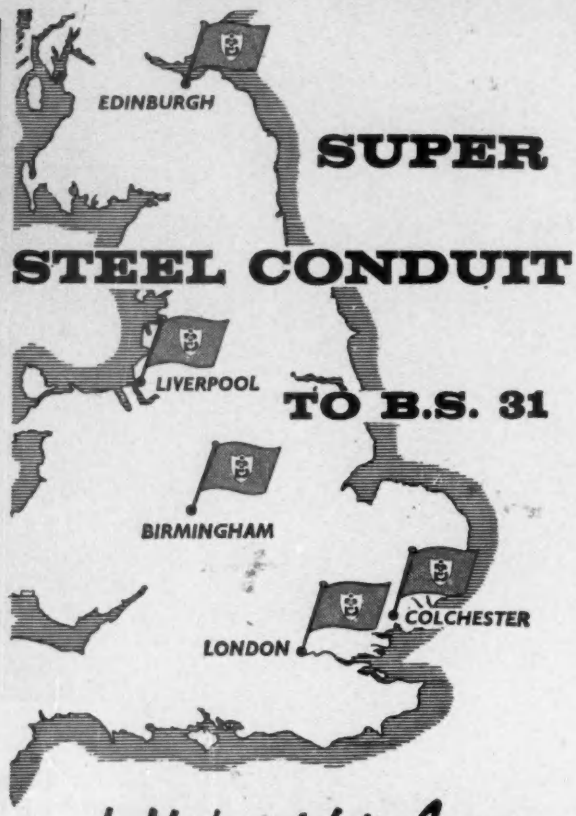

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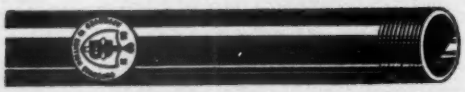

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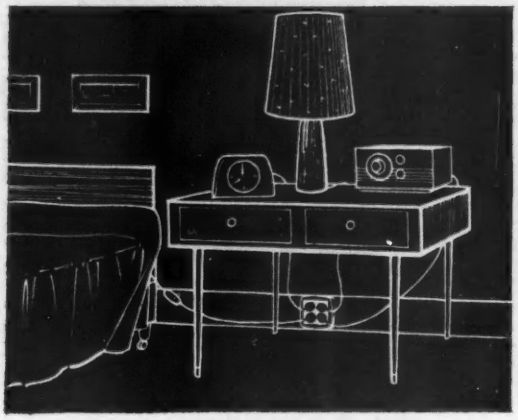

The 13 amp socket outlet and fused plug has been designed particularly for use on ring circuits and is ideal where single outlets only are required.

There are, however, certain positions in the house, e.g. the fireside and bedside, where the need is apparent for a socket outlet which will accommodate a greater number of small consuming devices such as radio and television sets, floor standards and reading lamps, electric blankets, etc.

To meet these requirements M.E.M. offer the bedside and fireside socket outlets, the latter bringing together BS 1363 and BS 546 outlets in a most useful combination. It is thus possible to provide three or four socket outlets from one point yet the overall size of the new units (4" x 3½") is only slightly larger than a single 13 amp socket outlet. A surface pattress enables the conversion of any already installed single 13 amp flush socket outlet to a three or four gang surface unit in a few minutes, at the cost of little more than an adaptor, and with no disturbance to existing wiring.

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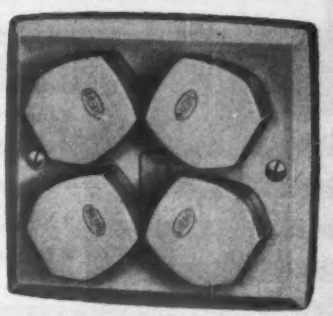
It consists of one 13 amp 3 pin BS 1363 outlet and two 2 amp 3 pin BS 546 outlets, the latter being protected collectively by a 5 amp BS 646 cartridge fuse-link which is housed in a self-ejecting carrier mounted on the front plate.

BEDSIDE SOCKET OUTLET

The bedside unit comprises four 2 amp 3 pin BS 546 outlets protected collectively by 5 amp BS 646 cartridge fuse-link which is housed in self-ejecting carrier mounted on the front plate. An unfused pattern is also available.



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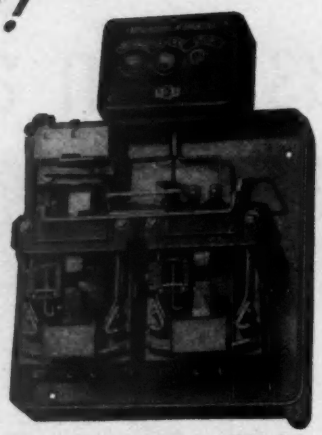
Illustrated is starter with built-on push button station suitable for squirrel cage motors up to 7½ h.p. Heavy duty starters available for controlling motors up to 30 h.p.



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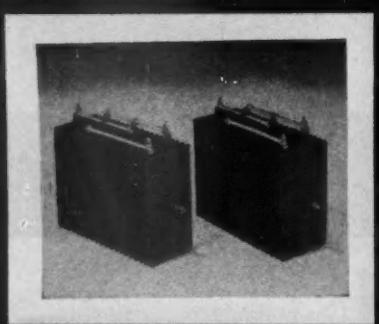

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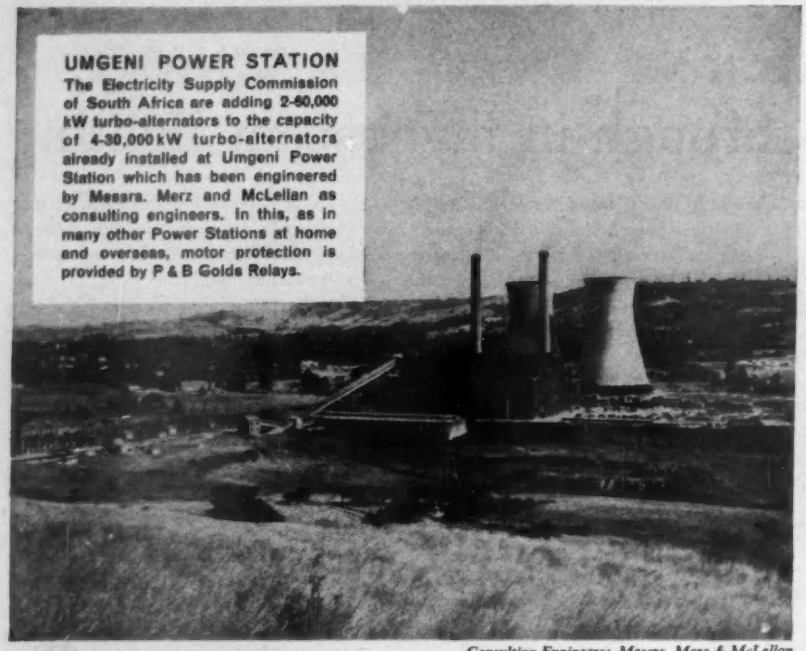

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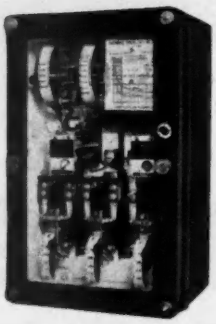

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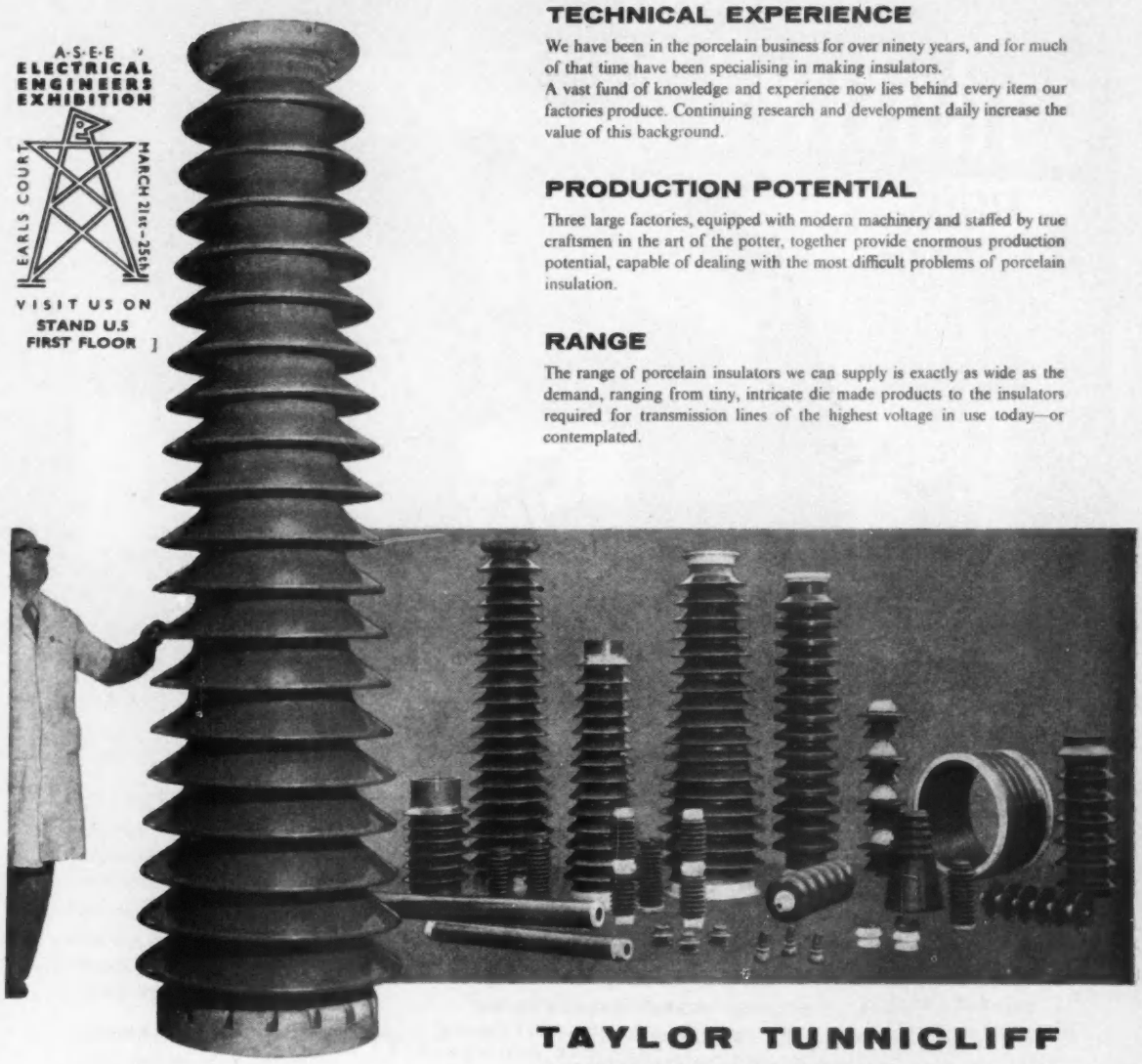

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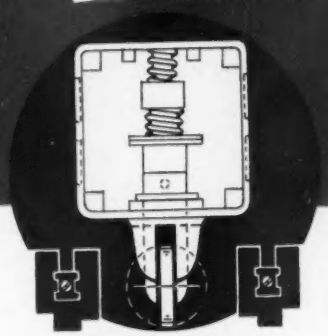
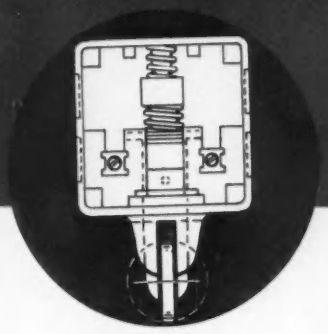
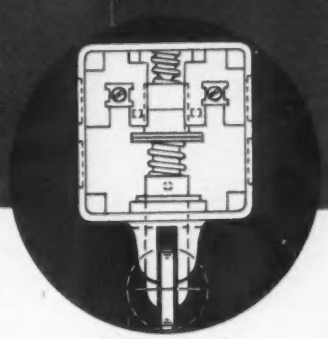


Removable Contact Blocks can be quickly removed and re-inserted into new positions as indicated in these diagrams.



Interior showing NORMALLY CLOSED position.



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